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PRELIMINARY ENVIRONMENTAL LIABILITIES RISK ASSESSMENT (ELRA)

IE LICENCE APPLICATION

Technical Report Prepared For

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Our Reference

GR/18/10501R02b

Date of Issue

24 June 2019

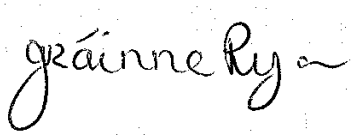
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Document History

Document Reference		Original Issue Date	
GR/18/10501R02		11 December 2018	
Revision Level	Revision Date	Description	Sections Affected
A	08 January 2019	Changes requested by Client	All
B	24 June 2019	Changes requested by Client	All

Record of Approval

Details	Written by	Approved by
Signature		
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Title	Senior Environmental Consultant	Senior Environmental Consultant
Date	24 June 2019	24 June 2019

EXECUTIVE SUMMARY

Indaver Ireland Ltd. (Indaver) plan to operate a Waste to Energy (WtE) facility, with approval to accept up to 240,000 tonnes per annum of waste, at Ringaskiddy, Co. Cork. The facility will operate under an Industrial Emissions (IE) licence issued by the EPA. The IE licence will be granted with main activity Class No. 11.3.0 'Waste' and will fall within the scope of the following Directive Annex I category:

Category 5.2: Disposal or recovery of waste in waste incineration plants or in waste co-incineration plants:

(a) for non-hazardous waste with a capacity exceeding 3 tonnes per hour;

(b) for hazardous waste with a capacity exceeding 10 tonnes per day.

This document presents the preliminary Environmental Liability Risk Assessment (ELRA) required as part of Indaver's IE licence application. This document will be updated following detailed design and prior to commencement of activities on site. It has been prepared in accordance with the requirements of the EPA (2014) publication "*Guidance on Assessing and Costing Environmental Liabilities*".

A risk identification of all planned processes on site has been undertaken and all plausible risks identified. A statement of measures to be undertaken to minimise current environmental risks is provided. The plausible worst-case scenario has been quantified and predicted costings prepared to allow for calculation of a financial provision.

The assessment detailed in this report has determined that, taking the most plausible worst-case scenario (and including for a contingency), a provision of €4.345M will be required. The primary purpose of the financial provision is to ensure that sufficient financial resources are available to cover the most plausible worst-case scenario that may arise over the lifespan of the facility.

Indaver will hold extensive Environmental Liability Insurance for the facility but it is proposed that a bond will act as financial provision for the identified unknown liabilities. Discussions with the EPA are anticipated towards determining the nature and amount of financial provision required for the facility.

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1.0 INTRODUCTION

Indaver Ireland Ltd. (Indaver) commissioned AWN Consulting Ltd. (AWN) to undertake their preliminary Environmental Liabilities Risk Assessment (ELRA) and Closure, Restoration and Aftercare Management Plan (CRAMP) as part of the IE Licence Application for their Waste to Energy facility at Ringaskiddy, Co. Cork.

The Agency requires an independent professional assessment and costing of potentially significant environmental liabilities that could arise during the life of the facility. The requirement for costing such liabilities is to ensure that the facility could make adequate financial provisions, via a financial instrument or other appropriate means, for remediating the potential environmental impairment associated with such liabilities.

This document presents the preliminary Environmental Liabilities Risk Assessment (ELRA) as required by the Agency. The preliminary Closure, Restoration and Aftercare Management Plan (CRAMP) is presented under a separate cover (AWN Ref. GR/18/10501R01). Both documents are prepared in accordance with the 2014 EPA publication entitled *'Guidance on Assessing and Costing Environmental Liabilities'*.

This risk assessment has been prepared by an independent and appropriately qualified environmental consultant:

AWN Consulting Ltd.
The Tecpro Building,
Clonshaugh Business & Technology Park,
Dublin 17.

1.1 Site Description (Activity and Context)

Indaver's facility is designed to incinerate and recover energy from the residual fraction of non-hazardous household, commercial and industrial waste, wastewater sludges and certain hazardous waste materials. The licensed activities are;

Category 5.2: Disposal or recovery of waste incineration plants or in waste co-incineration plants:

(a) for non-hazardous waste with a capacity exceeding 3 tonnes per hour;

(b) for hazardous waste with a capacity exceeding 10 tonnes per day.

This report is being submitted as part of the IE Licence application for the facility and will be updated following detailed design prior to commencement of the activities on site.

1.2 Scope of Work

The scope of work for the ELRA is principally defined by the 2014 EPA publication entitled *'Guidance on Assessing and Costing Environmental Liabilities'*.

The scope of the work for preparation of this ELRA includes the following:

- Review of IE licence application documents, site maps, and ELRA of the other Indaver WtE facility, in Co. Meath;
- Risk identification;
- Risk assessment;

- Identification of risk mitigation measures and the development of a risk management programme; and
- Quantification of the plausible worst-case scenario.

Based upon a review of the licence application documents, desk-top research, and discussions with Indaver management, a thorough assessment was made of the possible environmental liabilities associated with the site and the plausible worst-case scenario to which costs could be assigned.

1.3 Key Assumptions

There is a reasonable degree of uncertainty involved in environmental liability risk assessment and it is important to identify any assumptions at an early stage.

It is assumed that Indaver will maintain the Cork WtE site in accordance with the conditions of the IE licence (once granted). No provision has been made for costs associated with any legal proceedings that could arise, as firstly, there is goodwill and a strong desire by Indaver to remain compliant with relevant legislation and the Agency's requirements, and secondly, such costs are uninsurable and, therefore, cannot be underwritten by any third party or insurance organisation.

The preliminary ELRA has been based upon historic uses of the site and current operational activities. This report has not considered the potential environmental liabilities associated with significant changes in use of the site, such as redevelopment for other commercial or industrial purposes by Indaver or any other party, as these would require a separate risk assessment exercise, should they arise.

It should also be noted that the risk assessment does not include a costing of the final clean-up of the site after closure. This is set out in the Closure, Restoration and Aftercare Management Plan (attached under separate cover).

1.4 Disclaimer

This report is based on information supplied by Indaver to AWN. This report has been prepared for the use of Indaver only and for submission to the Agency as part of an IE Licence application. Specified costs are based on best estimates within the market place at the time of submission and will vary with time.

2.0 SITE EVALUATION

The site is located approximately 15km to the south-east of Cork City, in the townland of Ringaskiddy on the Ringaskiddy Peninsula in the lower part of Cork Harbour. The site covers an area of approximately 13.55 hectares and is situated on a north-facing slope. It is currently covered in scrub and some pockets of trees and open grass areas.

A site location map including the surrounding areas is presented in Figure 1 at the end of this report.

The L2545, the main road from Ringaskiddy village to Haulbowline Island, forms the northern boundary of the site. The eastern boundary of the site extends to the foreshore of Cork Harbour along Gobby Beach. The lands to the immediate south and west are in agricultural use. The site surrounds the Hammond Lane Metal Recycling Co. Ltd. Facility. The site is located approximately 800m east of the village of Ringaskiddy. Just beyond the southern boundary, the site is further visually defined by a high voltage electricity line.

The Ringaskiddy peninsula is industrial in character. It is home to the Port of Cork, and a number of pharmaceutical companies have large manufacturing facilities in the area. Recent additions to the Ringaskiddy area include four 100m hub-height wind turbines, located on industrial sites. The DePuy wind turbine is located to the south of the Indaver site. Further wind turbine developments have been granted planning permission and will be developed in the coming years also.

The Cork Harbour area has a number of urban developments, such as Ringaskiddy, Cobh, Rushbrooke and Monkstown, and pockets of industry near the shore.

Indaver Ireland Ltd. is part of the Indaver Group which operates and manages waste facilities across Europe in more than 30 locations in Ireland, Belgium, Germany and the Netherlands. In Ireland, Indaver also operates a WtE facility in Co. Meath and a hazardous waste disposal and recovery facility at Dublin Port. The Cork WtE facility received planning permission in May 2018 to accept up to 240,000 tpa of waste for incineration (of which 24,000 tpa may be hazardous waste) and is anticipating being licensed for same. The facility is capable of generating up to 21MW of electricity from heat generated by the process. There will be circa 63 Indaver employees at the facility.

2.1 Description of Site Processes and Activities

An inventory of facility buildings/areas is presented below.

- Main process building, incorporating:
    - Waste processing areas (including Tipping Hall, Waste Bunker, Furnace and Boiler);
    - Control room;
    - Flue Gas Treatment and Abatement.
- Administration and Security Building;
- Building housing the air-cooled condenser;
- Bottom Ash Treatment and Storage Building;
- Solidification Plant;
- Turbine Hall;
- Aero Condenser;
- Workshop;

- Warehouse (below Tipping Hall);
- Diesel Generator;
- ESB substation;
- 2 no. Weighbridges;
- Light Fuel Oil Storage Tank, Aqueous Ammonia Storage Tank, and Aqueous Waste Storage tank;
- Unloading area (for fuel oil, ammonia and aqueous waste); and
- Fire Water storage tank and pump house.

The primary structure on site is the main process building where waste will be received and incinerated. There are a number of ancillary structures around the main building to support the main site activities. The majority of the site is covered in concrete or tarmacadam hard-standing with the rest consisting of grass and/or vegetation cover.

There is one main access road from the site entrance leading past the staff carpark, the weighbridge, and the Administration and Security building to the Main Process Building. There is two-way traffic on the road around the site to the rear of the Tipping Hall.

The proposed site layout is provided in Figure 2.

2.1.1 Main Process Building

The main process building will be a large structure comprised of difference elements in series to facilitate receiving and incineration of waste and manage the process by-products. The main process building will be circa 176m long and 81m wide. The building height will be up to 50.7m above Ordinance Datum (mOD). The top of the venting stack at the western end of the site will be 70m above ground level.

The main part of the building will be largely a single space, with sub-divisions as required by the process.

The furnace, boiler and flue gas cleaning equipment will be located in the building. The bottom ash handling area will be located in the building at the south side. The boiler feed water treatment equipment, boiler feed water tank, will be located between the boiler and the steam condensate area within the building. The transformers and high voltage switch room will be located in the building along the northern side. The lime silo, boiler ash silos, flue gas cleaning residue silos and activated carbon or activated clay storage area will be located inside the building along the south side.

Waste materials will be transported to the site on a daily basis by waste contractors. On entering the site, waste contractors bring the waste to the tipping hall where inspections of the waste will be carried out on a routine basis by Indaver. Waste will be discharged into a chute in the wall/floor of the tipping hall and will be gravity fed into the waste bunker. There will be six chutes into which waste will be tipped. Therefore, a number of trucks will be able to empty the waste into the reception hall over a short period of time. The tipping hall and waste bunker will be under negative pressure with the air extracted from these spaces used for primary combustion air.

The workshop will be located on the northern side of the main process building. The workshop will be used by the maintenance team on site for repairs and will contain tools and equipment such as a welding facility, grinders etc.

The warehouse will be located underneath the tipping hall. The warehouse will be used for storage of spare parts and consumable such as personal protective equipment.

A perimeter access road surrounding the main production building providing vehicular access to the main building as well as other buildings on site.

On the north east side of the main process building there will be a multi-storey admin area that will house the production team for the operation of the facility. This will include offices, changing facilities, meeting rooms, the main control room and possibly a laboratory for testing incoming and outgoing waste streams.

There will be a nitrogen generator and nitrogen buffer storage vessel located just to the south of the process building. The unit will provide nitrogen blanketing for the liquid aqueous waste tank.

A schematic of the waste incineration process is provided below (Figure 2.1).

The primary facility processes and activities are summarised as follows:

Inputs:

- Waste material feed;
- Chemicals;
    - Quicklime
    - Hydrated Lime
    - Expanded Clay (dioxorb)
    - Activated Carbon
    - Ammonia Solution (25% v/v).
- Electricity (imported from national grid and on-site generation);
- Diesel;
- Water.

Unit Operations:

- Waste receiving, offloading and inspection;
- Waste mixing;
- Hopper feed to furnace;
- Waste incineration;
- Ash collection;
- Metal recovery;
- Ammonia solution injection;
- Combustion gas treatment;
- Turbine operation for electricity generation;
- Direct injection of aqueous wastes;
- Solidification of residues (boiler ash and flue gas residue).

Outputs:

- Waste disposal/recovery from incineration process;
    - Bottom Ash;
    - Boiler Ash;
    - Flue Gas Residue;
    - Boiler Ash & FGR as solidified blocks;
    - Ferrous Metals;
    - Non-Ferrous Metals;
    - Electricity.
    - Other irregular waste streams e.g. Aqueous liquid waste from boiler draining during shutdowns;
- Waste for offsite treatment which is generated during operations;

- WEEE;
- Wood (broken pallets);
- C & D.

It is proposed that the facility will be licensed to accept waste materials from 07:00-18:30 Mon-Fri and 08:00-14:00 on Saturday, while the incineration plant will be licensed to operate 24 hours per day, Monday to Sunday inclusive.

2.1.2 Ancillary Facilities

There will be an administration and security office block located to the front of the site which will comprise the main administration operations of the facility.

Storage Areas

A double skinned tank for the storage of light fuel oil will be located south of the process building. Light fuel oil will be used to heat up the waste-to-energy facility to conditions ready for waste and keep the incineration temperature above 850°C during operation on waste. A double skinned aqueous ammonia tank will be located to the east of the fuel oil storage tank. Aqueous ammonia is used as a reagent for the reduction of nitrogen oxides in the flue gases.

Directly to the north of the light fuel oil storage tank, a common unloading area will be provided for deliveries of both light fuel oil and aqueous ammonia. This area will be contained in the event of any leaks of spills during unloading operations.

Aqueous wastes include wastes such as water waste streams with mixed solvents and/or inks, contaminated water from firefighting and clean-up operations, storm water and leachate from landfill sites etc. A single skinned tank located in a bund for the storage of aqueous waste will be situated to the east of the light fuel oil storage tank. Aqueous waste deliveries will either be unloaded into the tank or fed to the furnace directly (direct injection). Unloading time will be approximately 1 hour into the tank and up to 24 hours when fed by direct injection. The feeding rate from the storage tank and by direct injection will be the same and fully controllable up to a maximum of 2,500 litres per hour (average of 2,000 litres per hour).

The unloading area will be located to the west of the storage tank and will be designed to contain any potential spills or leaks from unloading operations. An overhead gantry will be provided to facilitate sampling and inspection of the tankers delivering aqueous waste.

Utilities

The water requirements for the site will be supplied from Irish Water main along the L2545 road, which forms the northern boundary of the site. The major water requirement will be for flue gas cleaning due to cooling by direct water injection and the wet de-slagger. Process water (for the steam cycle), domestic potable water and water for cleaning account for the rest of the demand.

Wastewater Treatment

Domestic sewage from toilets, changing and kitchen areas will discharge via the foul drainage system and will be pumped directly to the Irish Water sewer located east of Ringaskiddy Village, which will then be pumped to the Shanbally Wastewater Treatment Plant (WWTP).

2.2 Inventory of Raw Materials, Products and Waste

An inventory of the primary raw materials, products and wastes for the site along with storage capacities and details are provided in Appendix A.

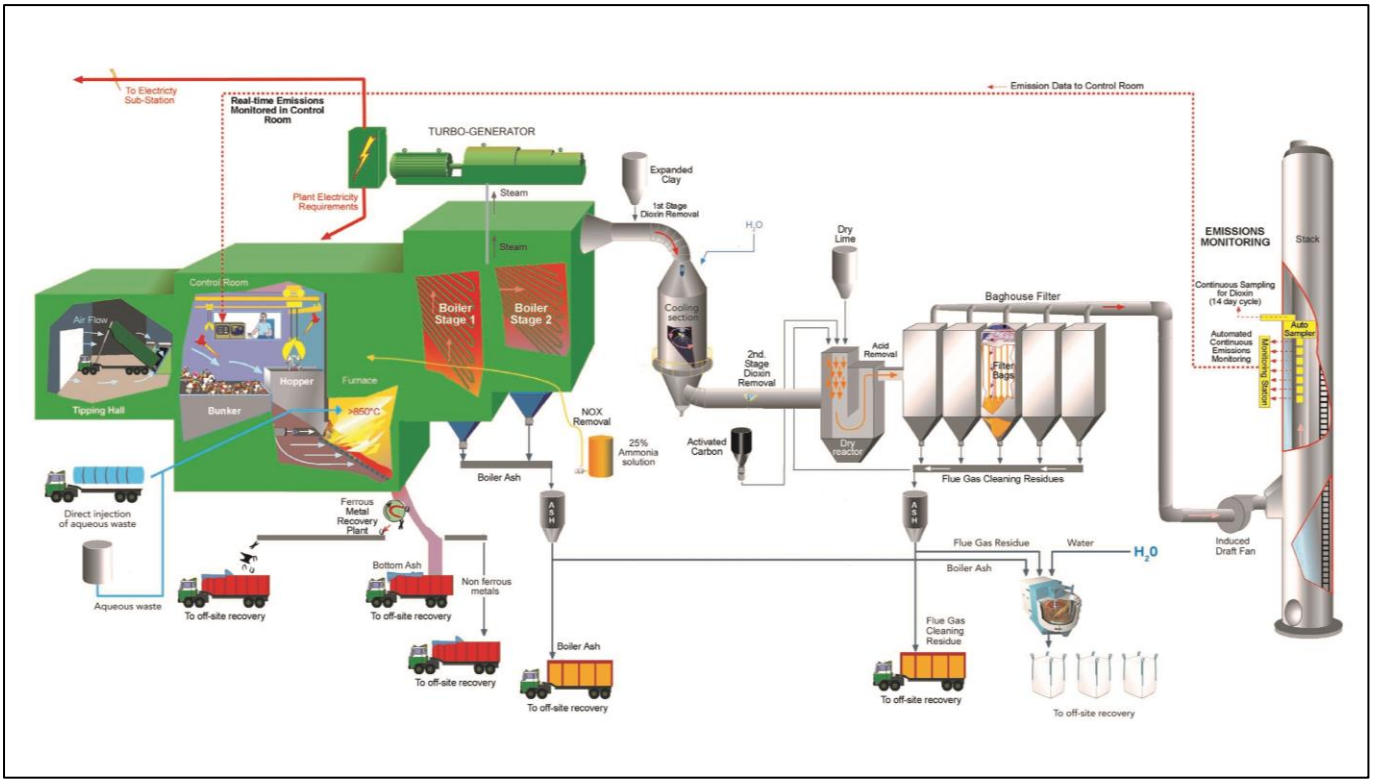
Figure 5 shows the layout of chemical and waste storage areas.

2.3 Unit Operations

The WtE plant consists of a number of main processes and items of plant as follows:

- Waste Reception;
- Moving Grate Incinerator;
- NO_x – Ammonia Solution Injection;
- Waste Heat Boiler;
- Turbine;
- Cooling Tower;
- Activated carbon and Expanded Clay injection;
- Baghouse Filter;
- Ash Handling;
- Emissions Monitoring Station;
- Solidification plant;
- Aqueous unloading area.

A simplified schematic of the overall incineration process flow is shown below in Insert 2.1.



Insert 2.1 *Simplified process schematic*

Waste Reception

Waste trucks will drive onto the weighbridge, located at the entrance. All trucks carrying waste, which enter and leave the facility, will be weighed. Drivers will present their documentation, relating to the waste load, to the staff in the security gatehouse. Some trucks, on long-term contracts, carrying non-hazardous waste, will access the facility using a swipe card, which will record their details. The drivers of these trucks will not have to report to the security offices.

Following completion of the waste acceptance procedures, the trucks carrying waste will proceed via the site road to the enclosed tipping hall.

Any nonconforming waste will be consigned to a waste quarantine area outside the tipping hall where it will be held until alternative disposal arrangements are made.

Tankers of aqueous waste will be sampled and analysed prior to offloading into the aqueous waste storage tank or direct injection. This sampling may be done before or after arrival on site. If sampled and analysed on site, the sampling will be done in the aqueous waste unloading area adjacent to the aqueous waste storage tank.

Access for sampling of tankers on site will be provided by an overhead gantry. This gantry will also facilitate operations associated with offloading the tanker.

Operators will be located in the control room overlooking the bunker and will mix the waste using overhead grab cranes. The mixed waste will be fed to the highest point in the furnace via a hopper and forms a plug that isolates the furnace from the bunker. The reception hall will be enclosed and maintained under negative pressure to ensure there are no odour or litter emissions. The bunker will have an operational capacity of c. 4,100 tonnes, or the equivalent of c. 5 days operation of the facility, with a maximum possible capacity of approximately 8,000 tonnes.

Moving Grate Furnace

The waste in the hopper will be fed to the furnace at a controlled rate by feeding rams. The furnace will consist of a grate mechanism, which promotes the complete and efficient combustion of waste through slow and continuous movement, mechanical breakup and effective air distribution. The combustion of waste on the grate produces both gases and solid residues. The gases will pass into a post-combustion chamber situated over the grate, where further combustion takes place. Bottom ash will be discharged at the end of the grate into a water bath or 'wet de-slagger'.

The average residence time of waste in the furnace will be approximately one hour. Oxides of nitrogen (NO_x) are treated using Selective Non-Catalytic Reduction (SNCR). This will involve injecting an SNCR reagent (ammonia solution) at two levels into the post-combustion chamber. The control system in the furnace will monitor a range of parameters and makes adjustments to the process to ensure complete combustion and that emissions limits are met.

Boiler

The steam boiler will operate to 53 bar and 420°C, which are optimised steam parameters for electricity generation from waste incineration.

The boiler outlet temperature for the proposed development will be 160°C and is considered Best Available Technique (BAT). Such a temperature is required for the evaporation of excess water in the process and the minimisation or avoidance of liquid effluent.

The boiler will consist of a number of empty passes and a final pass with tube bundles. The empty flue gas passes will be constructed from membrane walls without obstructions such as tube banks. The empty passes will allow heat transfer from the flue gas to the evaporating water in the membrane walls mainly by radiation. There will be no tubes bundles in this section of the boiler as the fly ash will be sticky at temperatures above 650°C, and would quickly deposit on, and foul, the surfaces.

For the grate furnace the large empty first pass will allow sufficient time at high temperature to complete combustion. The lower part of the first pass will be refractory lined to avoid corrosion and to provide thermal insulation close to the furnace. The refractory lined part of the first pass of the boiler will be designed to ensure that the specified minimum residence time, temperature and oxygen content, after the last air/fuel injection, will be maintained, to ensure compliance with the IED Directive.

The primary purpose of the steam boiler/superheater/economiser will be to exchange heat between the flue gas and the water/steam circuit, which will produce steam for power generation. An estimated 85% of the energy produced by the combustion of waste will be recovered as steam in the boiler.

It is necessary with boilers to treat the feed water to the boiler to a high level of purity. The demineralised water demand will be in the order of 25m³/day. An equivalent volume of water will then be purged (also known as boiler blow-down) from the boiler to prevent the build-up of salts in the steam circuit. This will be re-used back into the process. Small quantities of boiler treatment chemicals will be added to the boiler water to prevent corrosion and scale build up in the steam circuit.

Electricity generation and Steam Cycle

Steam from the boiler at 53 bar and 420°C will be sent to the steam turbine which will drive a generator set to give an electrical output of approximately 21MW. Only about 2.5MW of this is required for use within the plant with the remaining 18.5MW available for export to the national grid.

To maximise energy recovery, steam leaving the turbine will be maintained at extremely low pressure by an air-cooled condenser. Using air cooled condensers rather than cooling water reduces water consumption and avoids water discharge. The flow of steam through the cycle will be approximately 94 tonnes per hour at 100% load. A small quantity of water will be purged constantly from the steam cycle and replaced with fresh make-up water from a water purification (demineralisation) plant. This 'boiler blow-down' will be reused within the process plant.

Flue gas treatment system

The flue gas treatment system will be designed to ensure emissions from the stack are well below limits set by the IED Directive 2010/75/EU. Typical dioxin emissions from a facility with this equipment are one tenth of the concentration limit in the IED Directive. The system will be designed to produce no effluent and to minimise the consumption of water, reagents and energy. The key stages of the treatment system include:

- A fixed amount of activated carbon or a carbon/clay mixture will be injected into the flue gases in the cooling stage and also into the flue gas either in the dry reactor or just after it. Activated carbon consists of small, porous carbon particles, which due to their porosity have a large surface area. Dioxins, furans, other trace organic compounds and heavy metals in the flue gases will be absorbed onto the activated carbon particles.
- Lime will be injected into the flue gas in the dry reactor to reduce the amount of acid in the flue gas.

- The flue gases will then pass through a baghouse filter which will remove the dust, salts and the carbon particles from the gases. The dust cake forming in the baghouse filter will be periodically removed and collected in hoppers located below it.
- Treated gases will then leave the 70m high stack at a temperature of ~140°C. The stack emissions will be monitored as required by the IED Directive and in compliance with the IE Licence.

Residues Handling

There will be three solid residues from the waste-to-energy facility in Cork: bottom ash, boiler ash, and flue gas cleaning residues. The category 'flue gas cleaning residues' includes filter ash from the baghouse filters.

It is expected that the bottom ash, boiler ash and flue gas cleaning residues from the Cork facility will be similar in composition to the bottom ash, boiler ash and flue gas cleaning residues from the Meath WtE facility whose operation and treated waste will be similar. In accordance with EPA methodology and Commission Regulation (EU) No 1357/2014 and Commission Decision 2014/955/EU, the bottom ash from the facility in Meath has been classified as non-hazardous, the boiler ash has been classified as hazardous, and the flue gas cleaning residues have been classified as hazardous.

An estimated 52,700 tonnes per annum of bottom ash will be produced in the facility. The bottom ash will be recovered or disposed to landfill, or if appropriate facilities are developed, will be recycled following treatment in Ireland.

An estimated 2,000 tonnes per annum of boiler ash and circa 9,100 tonnes per annum of flue as cleaning residues will be produced in the facility. The boiler ash and flue gas cleaning residues will be in the form of fine particles and will contain heavy metals.

The flue gas residues (FGR) and boiler ash will either be pre-treated prior to transport off site in bags or loaded directly into specialised tanker vehicles.. The boiler ash and FGR will be suitable for use to backfill the void space in an underground salt mine (permitted to receive waste under a recovery code) or will be disposed of in a hazardous waste landfill. In the event that such a facility is not available in Ireland, the boiler ash and flue gas cleaning residues from the Cork facility will be to underground salt mines in Germany.

An annual average of 2,400 tonnes of ferrous metals, such as mild steel, and 240 tonnes non-ferrous metals will be recovered from the bottom ash for recycling.

2.4 Emissions

A site layout map identifying the locations of all emissions and monitoring points is included in Figure 3.

2.4.1 Air Emissions

Main Emissions

There is only one-point source major emission from the 70m high stack through which treated flue gases are discharged (reference A2-1). The flue gases consist primarily of CO_2 and water vapour but may also contain a number of substances regulated by legislation. The parameters that will be required to be monitored at the stack discharge are:

- Total Dust: PM_{10} and $PM_{2.5}$;

- Total Organic Carbon (TOC);
- Hydrogen chloride (HCl);
- Hydrogen fluoride (HF);
- Sulphur dioxide (SO_2);
- Nitrogen Dioxide (NO_2);
- Cadmium (Cd) and Thallium (Tl);
- Mercury (as Hg);
- Antimony (Sb), Arsenic (As), Lead (Pb), Chromium (Cr), Cobalt (Co), Copper (Cu), Manganese (Mn), Nickel (Ni) and Vanadium (V);
- Dioxins/furans (PCDD/PCDFs); and
- Carbon monoxide (CO).

Minor Emissions

The minor emission points will be the boiler blow down tank (A3-1), HVAC exhausts (A3-2, A3-3, A3-5), the solidification plant (A3-4), the odour management system for the bunker during shutdowns (A3-6), the air compressors (A3-7, A3-8, A3-9), the diesel tanks for the fire water pumps (A3-10, A3-11, A3-12), the fuel tank vent (A3-13), the extraction lab fume hoods (A3-14), the extraction of the welding booth (A3-15), the boiler start-up valve (A3-16) and the deslagger extraction (A3-17). Please see attachment 7.4.2 of the licence application for further details.

Fugitive Emissions

To limit fugitive emissions from the facility, the bunker and tipping hall will be maintained under negative pressure. The storage, treatment and handling operations for waste, consumables and residues will be carried out in enclosed environments with filters or closed loop loading systems fitted where necessary. The storage area for consumables, boiler ash and flue gas treatment residues will be isolated within the main process building to contain any emissions that may arise from this area. There will be a fugitive management plan in place.

Odour Emissions

There will be no significant odour emissions from the facility as the bunker and tipping hall areas will be held under negative pressure during operations.

Monitoring of Odour emissions will be undertaken quarterly as part of an odour management plan to be developed for the proposed facility in compliance with the Odour Impact Assessment Guidance for EPA Licensed Sites (AG5).

2.4.2 Emissions to Sewer

Domestic sewage from toilets, changing and kitchen areas will discharge via the foul drainage system and the effluent will then be pumped to Irish Water's foul sewer located east of Ringaskiddy village.

2.4.3 Emissions to Ground

There will be no direct emissions to ground or groundwater.

2.4.4 Emissions to Stormwater

Proposed final discharge from the site will be at Emission Point SW-1. The discharge will be controlled using a pump from the surface water attenuation tank. The water will be pumped out at a greenfield discharge rate of 18l/s.

The discharge will enter the storm sewer along the road of which the outfall is into Cork Harbour at Gobby Beach.

2.4.5 Site Drainage

The drainage system for the site will be divided into three independent systems:

- Storm-water drainage system from roofs and outdoor hard-standing areas;
- Tanker unloading area; and
- Domestic type effluent system.

The eastern part of the site, when constructed will form a rainwater catchment area of 3ha consisting of roofed areas, roads and hard standings. The site will be provided with attenuation to store and control the stormwater discharge.

The stormwater from all of the roads and hard standings will be conveyed via class 1 hydrocarbon interceptors to the firewater retention, which will be known as tank no. 1. This firewater retention tank will have a capacity of 1,690m³.

The stormwater from the roofs of all of the buildings will be conveyed to the surface water attenuation tank, which will be known as tank 2. This surface water attenuation tank will have capacity of 1,250m³.

The surface water attenuation tank and the fire water retention tank will be located beside each other beneath the staff car park, which is adjacent the administration and security building. Stormwater from Tank 01 will flow to Tank 02 and continuous monitoring will be in place as well as a cut off valve to prevent contaminated water from Tank 01 entering Tank 02. Discharge from Tank 02 will be via an additional monitoring station and cut off valve into the storm sewer at SW-1.

The tanker unloading area, which is located adjacent to the fuel tank, will be provided with cut off drains to collect any spillage that may occur during the unloading of ammonia solution or fuel oil. A local holding tank with a 2m³ capacity will be provided. The outlet valve of the local holding tank will be closed during any tank unloading operation. If a spillage occurs during unloading, the spilled liquid will be collected in the local holding tank. The contents of the tank will then be pumped out and dealt with appropriately. When the unloading operation has finished, and no spillage has occurred the valve will be opened in the direction of the local forecourt interceptor and then on to the fire water retention tank.

The domestic effluent system is described previously above.

2.4.6 Noise Emissions

There will be a number of potential sources of continuous noise, all from process equipment at various points in the plant. The stack, air cooled condensers and turbine coolers will be the most significant continuous sources of noise as they will be located externally.

Traffic noise assessments have found site traffic to have little impact on overall noise in the locality and is therefore not considered to be a significant emission.

It is proposed that annual noise monitoring will be carried out at 4 locations as identified in Figure 3, upon agreement with the Agency.

2.5 Waste

Waste materials will be accepted at the facility as feedstock for the incineration and energy recovery processes. It is proposed that the facility will be permitted to accept a maximum of 240,000 tonnes of industrial, commercial and household non-hazardous waste per annum, which may include up to 24,000 tpa of suitable hazardous wastes. It is anticipated that there will be a number of suitable hazardous waste streams which may be included in the process feedstock. The list of licensed waste types along with their corresponding List of Waste (LoW) numbers are presented in the facility IE licence application.

A dedicated waste inspection area will be provided in the reception hall to facilitate the regular inspection of waste loads from new and existing contractors. The inspection area will drain to the bunker. Any non-conforming waste will be loaded into suitable covered containers or trucks, which are consigned to a designated waste quarantine area. The quarantine area will be located outside the tipping hall away from the main activity areas. The trucks or containers will be held in this area for a short period to allow the waste contractor time to make alternative disposal arrangements, if necessary. All refused loads of waste will be recorded.

Wood, iron, steel, soil and stones and mixed construction and demolition wastes will be collected from the facility by suitably permitted and licensed operators for recovery at licensed facilities. Ferrous metals and non-ferrous metals taken from the bottom ash will be recovered by suitably permitted and licensed operators.

Bottom ash generated at the facility which has been classified as non-hazardous at the Meath WtE facility will consist mostly of inert materials such as glass, sand, metal pieces and stones. Approximately 2,400 tpa of ferrous metals and 240 tpa of non-ferrous metals will also be separated out for recycling. Bottom ash will mostly likely be sent to non-hazardous landfills as described in Section 2.2.1.

Flue gas residues and boiler ash are classified as hazardous at the Meath WtE facility and are either, sent for recovery in the remediation of salt mines in Germany or after undergoing a pre-treatment process, sent for recovery to a salt mine in Ireland. This will be the case also at the Cork facility.

2.6 Nuisances

To limit nuisances such as vermin, dust emissions and litter, all deliveries, handling and storage activities will take place in fully enclosed environments. The main process building will be maintained under negative pressure and the facility will be kept clean and tidy at all times. Specialists vermin control contractors will be engaged to provide vermin management services. Roads, parking areas and service yards will be paved and therefore minimise the potential for the generation of dust. Measures for limiting the impact of traffic movements on the road network will include road widening, the provision of a ghost island junction to facilitate a turning lane and a 25km/h site speed limit.

2.7 Environment Pathways and Sensitivity

2.7.1 Geology and Hydrogeology

The site is located on the northern side of one of the east-north-east to west-south-west trending ridges known as the Ringaskiddy anticline. The site is underlain by Lower Carboniferous marine interbedded grey/brown sandstone, siltstone and mudstone

referred to as the Cuskinny formation of the Kinsale group. As the bedrock geology at this site is not limestone, there is no potential risk of solution features on the site.

The soil data from the EPA classifies the upper soil profile as acid brown earths that are glacial in origin and are derived from the parent bedrock of Old Red Sandstone and Carboniferous Limestone. Research into the soils revealed them to be a relatively mature, well-drained mineral soils possessing a rather uniform profile, with little differentiation into horizons. They occur on lime-deficient parent materials and are therefore acid in nature. They possess medium textures of sandy loam, loam and sandy clay loam. Detailed site investigations recorded a strategic profile of topsoil over orange/orange brown gravelly silt/clay over brown gravelly silt/clay becoming sandy gravelly silt/clay at the site.

The main hydrological feature in the vicinity of the site is the West Channel of Cork Harbour, which is adjacent to the eastern boundary of the site. The nearest rivers and streams are the Glounatouig Stream that flows into Monkstown Creek, approximately 3km to the west of the site, and the Owenboy River that flows into Cork Harbour, approximately 2.5km to the south of the site. The EIAR found at the time of the report the quality in Cork Harbour to be 'Unpolluted'.

The EIAR identified that groundwater is extensively used by the local community as a source of water supply with 19 recorded wells within 2km of the site, all are located south of the site.

2.7.2 Environmental and Ecological Designations

The Cork Harbour Special Protected Area (SPA) (Site ref. 0040300) is located approximately 0.5km to the south of the site and is designated for the protection of endangered species of wild birds.

The Great Island Channel Candidate Special Area of Conservation (SAC) (Site ref. 001058) is approximately 5km to the north of the site. It is a designated site for the Tidal Mudflats and Sandflats and the Atlantic Salt Meadows listed on Annex I/II of the E.U. Habitats Directive.

Ballycotton Bay SPA (Site ref. 004022) is approximately 18.4km to the east of the site. It is a designated site for the protection of endangered species of wild birds under the Birds Directive.

The Sovereign Islands SPA is approximately 19.7km to the south west of the site and is designated for the protection of the Cormorant species of birds.

2.7.3 Source Pathway Receptor Assessment

As part of the 2018 Soil Water Baseline assessment detailed further under Section 2.7.2 below, a source pathway receptor assessment was conducted. The pollutant linkages based on the primary sources of possible contaminants on site are summarised in Table 2.1 (extracted from the baseline report below). This CSM was presented on the basis that contamination following a leak/spill is not mitigated by the extensive mitigation measures operating at the site.

Source	Pathways	Receptor	Impact Assessment
Ammonia and/or Diesel Fuel Spill or leakage impacting lands outside containment area.	Vertical and lateral migration via shallow overburden to underlying bedrock Lateral migration via groundwater within the bedrock aquifer	Locally Important Bedrock Aquifer with Extreme to high vulnerability	Low – Tanks are bunded and on hard stand areas with a closed drainage system.
Tanker leakage impacting area outside of site drainage area.	Lateral migration via drainage system	Stormwater system & Western Channel Cork Harbour.	Low: - Closed drainage system, monitored and shut off valve in the event of a spill to drainage occurring.

Table 2.1 Extract from Soil Water Baseline Report – Pollutant Linkages

2.8 Operator Performance

2.8.1 Environmental Management System

Indaver has an integrated Quality, Environmental and Safety & Health (QESH) management system. These standards will be implemented at the Cork facility.

2.8.2 Soil and Water Baseline Study

AWN Consulting prepared a Soil and Water Baseline study for the facility in order to meet Indaver's licence application requirements under the Industrial Emissions Directive. The report concluded that the overburden across the site comprises variable thickness of clay with extreme to high vulnerability in places. The site is underlain by a Locally Important Aquifer. There are no downgradient water abstractions from the aquifer or groundwater dependent ecosystems. The primary water receptor is Cork Harbour.

A review of soil and water quality from the 2000/2001 baseline assessment and 2018 baseline assessment confirm that there is no evidence of any residual contamination beneath the site.

Ammonium Hydroxide (NH_4OH) Solution, Diesel/Light Fuel Oil, Aqueous Waste, Flue Gas residues and Boiler Ash were identified as hazards present at the site which have the potential to impact soil and groundwater if not adequately mitigated during storage and operation at the plant. However, the risk prevention measures present at the Indaver facility significantly reduce the potential for an environmental impact to soil or water to occur. These measures include bunding, closed drainage and containment systems and spill management procedures.

Source-pathway-receptor linkages were assessed for the bulk storage areas. It was concluded that there are no direct pathways to either the soil and groundwater environment or the surface water environment. A leakage from a bulk tank would be fully contained within the continuous hard stand delivery area. Any leakage outside of the delivery area would be contained within the closed drainage system.

2.9 Tank, Drum, Pipeline and Bund Integrity Testing

All bunds will be tested as per the standard requirements included in the conditions of the licence. A full list of the tanks, bunds and underground pipelines anticipated for the Ringaskiddy site, with their use and size, is included below.

Bund ID	Item	Description	Size
1	Aqueous Waste Unloading Area	Aqueous Waste Unloading Area	30m^3
2	Chem Store Workshop	Chem Store Workshop	10m^3
3	Chem Store Tipping Hall	Chem Store Tipping Hall	10m^3
4	Sump Tank Solidification Plant	Sump Tank Solidification Plant	5m^3
5	Transformer bunds under electrical rooms	Transformer bunds under electrical rooms	15m^3
6	Transformer compound in sub station	Transformer compound in sub station	16m^3
7	Fire water retention tank	Fire water retention tank	1690m^3
8	Surface water retention tank	Surface water retention tank	1250m^3
9	Clean Water Pit	Clean Water Pit	70m^3
10	Dirty Water Pit	Dirty Water Pit	70m^3
11	Liquid Aqueous Waste Tank	Liquid Aqueous Waste Tank	100m^3
12	Ammonia Tank	Ammonia Tank	70m^3
13	Fuel Tank	Fuel Tank	25m^3

Table 2.2 Site Bund Details

2.10 Risk Management

Indaver are committed to managing and conducting their work activities in such a way as to ensure, so far as is reasonably practicable, the safety, health, and welfare at work of their employees and others who may be affected by their business activities and also to minimising pollution and adverse impacts on the environment.

The plant will be operated in line with Indaver's Integrated Management System (IMS) incorporating their Quality, Environmental, Safety and Health (QESH) systems which are accredited to ISO 9001 (Quality), ISO 14001 (Environmental) and OHSAS 18001 (Safety and Health).

<u>Accident Prevention and Emergency Response:</u>

During the design phase of the plant, hazard and operability (HAZOP) studies will be carried out to assess hazards that could arise during both steady and non-steady state operations and identify the necessary mitigation measures required. Based on these

studies, a comprehensive set of operating procedures will be drawn up for all aspects of the operation of the plant, to minimise the risk of accident or emergency situations arising.

A comprehensive Emergency Response Plan will be developed for the facility. The procedure will set out the response measures to be taken by personnel in the event of an emergency. Measures have been designed to ensure maximum protection for site employees, visitors and people in other premises near the site to limit damage to property and minimise the impact of site operations on the environment. A dedicated Emergency Response Team will be appointed to respond to any emergency which may arise. A draft Emergency Response Plan is included in Attachment 9-1 to the IE licence application.

Employee Training:

Indaver strives to minimise human interaction in safety critical operations in order to eliminate the potential for 'human factors' to initiate or exacerbate major accidents at the site. Through recruitment, training, performance management, employee development and succession planning, the company will ensure all members of staff are in possession of the knowledge, skills and experience necessary to perform their jobs to a satisfactory standard. This includes adhering to strict rules on safety such as a working permit system, training and provision and use of personal protection equipment.

All staff will be fully trained for all aspects of operation of the facility. Training is managed by means of a Training and Staff Competence Procedure.

Calibration and Maintenance Systems:

Calibration and maintenance of equipment will be managed through the company's quality management system which is accredited to ISO9001:2015.

3.0 ENVIRONMENTAL SENSITIVITY

3.1 Risk Identification

To complete this risk assessment in accordance with the requirements of the 2014 EPA guidance, AWN considered the activities carried out at the facility and generated a list of the primary processes and activities with potential to generate environmental effects with reference to Table 3.2 of the EPA guidance document.

In identifying the environmental hazards at the site, the operations and activities have been divided into the following broad categories:

1. Vehicle movements;
2. Tipping Hall;
3. Storage and mixing of wastes;
4. Thermal treatment of wastes;
5. Ash handling and storage;
6. Air emissions treatment process;
7. Fires and fire water;
8. Ancillary services;
9. Other risks including generic risks.

A list of the significant risks identified at the facility is presented in Table 3.1.

Risk ID	Process/Area	Potential Risk
1. Vehicle Movements		
1.1	Truck movements around the site including waste and supply deliveries.	Release of diesel from a truck fuel tank or similar vehicle (< 500 litres) due to crash, accident or overfill/non-closure of fuel tank.
1.2	Truck carrying sludge waste to waste bunker.	Accidental release of sludge waste (up to 30m^3) to hard-standing area.
1.3	Truck delivering lime to site, expanded clay or carbon to site	Lime spill (<26t) on delivery which could disperse in the atmosphere (powders)
1.4	Truck delivering caustic (sodium hydroxide solution) (jerrycans) or nitric acid (IBCs) to site	Sodium Hydroxide (25l) or nitric acid delivery spill (<1m^3).
1.5	Truck delivering solid waste (hazardous and non-hazardous)	Solid waste spilled accidently onto hard-standing (<30t).
1.6	Truck carrying liquid waste (non-hazardous and hazardous) to liquid waste unloading area.	Accidental release of non-hazardous liquid waste (up to 30m^3) to hard-standing area which has the potential to release into the surface water drainage system.
1.7	Trucks carrying solidified material from pre-treatment plant	Accidental release of FIBC bags that contain the hardened material. The blocks could break and disperse to the atmosphere
2. Tipping Hall		
2.1	General waste load accidentally containing unapproved hazardous waste component enters facility and is placed in waste bunker.	General waste load accidently containing unapproved hazardous waste component enters facility and is placed in the waste bunker. It is then transferred into the hopper and incinerated in the furnace.

2.2	Radiation detector scanning waste loads for radioactive material entering the facility.	Failure of the radiation detector in scanning the waste and radioactive material entering the facility and waste bunker undetected.
2.3	Waste entering the bunker which is outside of acceptance criteria entering bunker	The waste would enter the hopper and be incinerated. Potential for shutdown due to size reasons i.e. cause a blockage in the hopper.
3. Storage and mixing of wastes		
3.1	Waste storage bunker	Leak in waste bunker floor leading to leachate entering groundwater beneath the site.
3.2	Aqueous Waste Storage Tank	Incompatible wastes mixed in which could cause fire or explosion
3.3	Road Tankers containing liquid (hazardous and non-hazardous) for treatment	Tankers could leak which could enter surface water drainage system.
4. Heat treatment of wastes		
4.1	Furnace explosion	Explosion in the furnace e.g. if gas cylinder/petrol can/explosive entered in waste stream
4.2	Risks associated with emissions due to poor combustion in the incinerator	Generation of excessive/non-conforming combustion gases
4.3	Burning of Unapproved waste in the incinerator	Generation of excessive/non-conforming combustion gases
5. Ash handling and storage		
5.1	Bottom ash wet bath	Release of liquid from bottom ash wet bath.
5.2	Boiler ash silo/flue ash silo (located indoors)	Discharge from ash silo (<1t) with no collection truck in place.
5.3	Ash silo otherwise overflowing	Uncontrolled release of ash to the surrounding area.
5.4	Bottom Ash Hall	Dust Explosion in bottom ash hall
6. Air emissions treatment process		
6.1	Ammonia solution tank	Failure of the ammonia solution tank due to puncture or catastrophic failure (<80m^3).
6.2	Ammonia solution tank	Small loss of ammonia solution from tank or pipeline leak.
6.3	ID fan at stack	Failure of ID fan before the stack.
6.4	Failure of the Air Abatement System	Short term release of excessive air emissions in breach of ELV.
6.5	Release of unabated emission to atmosphere	Short term release of excessive air emissions in breach of ELV.
6.6	Impact on abatement systems due to extreme cold temperatures	Partial failure of abatement equipment resulting in short term release of excessive air emissions in breach of ELV. All abatement equipment will be located within weatherproofed buildings i.e. within the main process buildings and extreme cold weather is not considered to present a problem for the facility other than in all but the most unlikely of scenarios.
6.7	Aqueous waste tank	Failure of the aqueous waste tank due to puncture or catastrophic failure (<250m^3).
6.8	Aqueous waste tank	Small loss of aqueous waste from tank or pipeline leak.

7. Fires and firewater		
7.1	Contractors' compound workshop fire	Major fire in contractors' compound building leading to destruction of materials stored and release of smoke. Generation of fire water.
7.2	Major fire within waste storage area or incineration process	Release of fire water and/or foam following a major fire in a waste storage or processing area of the site.
7.3	Major fire within waste storage area or incineration process	Potential for release of smoke to the atmosphere.
7.4	Waste bunker storage	Major fire in the waste bunker leading to generation of fire water.
7.5	Trucks arriving to site on fire	Waste from the supplier may be on fire due to burning embers or ignition of the waste by the fermentation process.
8. Ancillary services		
8.1	Light fuel oil tank storage	Light fuel oil tank failure/puncture and potential release of up to 60m^3 of fuel to ground.
8.2	Generator diesel tank storage and fire pump diesel tank	Diesel tank failure and release of up to 7m^3 of diesel to ground.
8.3	Domestic effluent treatment process	Failure of domestic effluent treatment system or release of untreated domestic type effluent to groundwater.
8.4	Transformer Compound	Release of up to 8.4 tonne of transformer oil (PCB free) to bund.
8.5	Transformer Compound	Potential for release of Sulphur hexafluoride (SF6) gas into the atmosphere.
8.6	Pre-Treatment Plant	Spill of hazardous residue onto floor or which could get into the environment e.g. explosion. Dry boiler ash or flue gas residue could escape into the atmosphere.
8.7	Pre-Treatment Plant	Spill of partly solidified material onto ground and entering drainage system.
9. Other Risks (including Generic Risks)		
9.1	Flooding on site causing uncontrolled damages	Floodwaters entering process buildings area or causing damage to process/utility equipment, pipeline or tank damage.
9.2	Failure of the surface drainage water network, causing releases to ground.	Loss of potentially contaminated surface water to ground.
9.3	Activities of contractors, causing release of materials to atmosphere, surface water, groundwater, noise, dust etc.	Generation of environmental nuisances (air emissions likely to be dust or other particulate matter) or contamination of soil, groundwater, or surface water as a result of contractor's activities.
9.4	Failure of the tanks to contain storm water or fire water	Overflow or leak from tanks.
9.5	Failure of the foul sewer drainage system	Leak of foul waste into the ground and ultimately into the groundwater.

Table 3.1 Plausible risks identified for Indaver facility

4.0 RISK ANALYSIS

The risks identified have been assessed in terms of their likelihood and consequence based on the classifications presented in Tables 4.1 and 4.2. The consequence rating in terms of potential environmental impacts and costs of a hazard occurrence given the existing controls are presented in Table 4.1. The cost reflects the expense that may be incurred in managing and rectifying the hazard event. Table 4.2 rates the likelihood of the potential hazard occurring given the existing controls.

Rating	Consequence	
	Category	Description
1	Trivial	No impact or negligible change to the environment
2	Minor	Minor impact/localised or nuisance
3	Moderate	Moderate impact to the environment
4	Major	Sever impact to the environment
5	Massive	Massive impact to a large area, irreversible in the medium term

Table 4.1 *Risk Classification Table – Consequence*

Rating	Likelihood	
	Category	Description
1	Very Low	Very low chance of hazard occurring
2	Low	Low chance of hazard occurring
3	Medium	Medium chance of hazard occurring
4	High	High chance of hazard occurring
5	Very High	Very high chance of hazard occurring

Table 4.2 *Risk Classification Table - Likelihood*

Table 4.3 over presents the risk assessment of the identified risks listed previously. For each risk, the table presents the nature of the hazard and its potential environmental effect. A consequence (C) and likelihood (L) rating is assigned to each risk and a risk score is generated based on the product of the two ratings (i.e. C x L). This risk score allows the identified risks to be ranked.

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
1. Vehicle Movements								
1.1	Truck movements around the site including waste and supply deliveries.	Release of diesel from a truck fuel tank or similar vehicle (< 500 litres) due to crash, accident or overfill/non-closure of fuel tank.	Release of diesel to surrounding hard-standing area entering the surface water drainage system. Potential release to road at site entrance if occurrence at entrance.	2	A spill entering the water drainage system will pass through the Class 1 by-pass petrol interceptors, where oil contamination will be contained, before entering the firewater retention tank or being diverted to the surface water retention tank once TOC levels exceed set parameters. This is a localised and short duration event with any fuel spilled contained within the surface water drainage system for the site.	2	Truck activities (deliveries of waste, collection of ash and supply deliveries) will take place daily. The site will operate a well-marked two-way traffic flow system with a wide turning area for waste delivery vehicles to reduce the potential for vehicle collisions. 25 km/h speed limit will be in place on site. Vendor vetting procedures will be used to ensure reputable vendors are used for deliveries. Spill procedures will be in place.	4
1.2	Truck carrying sludge waste to waste bunker.	Accidental release of sludge waste (up to 30m^3) to hard-standing area.	Release of waste sludge to surrounding hard-standing area entering the surface water drainage system or potentially contaminate soil.	2	Any significant release of sludge waste to the water drainage system on the site will trigger the TOC alarm located before the surface water retention tank. This surface water runoff will then be retained in the fire water retention tank, preventing it reaching any external water bodies. There will also be an additional alarm at the	2	Truck activities (including deliveries of sludge) will be typically less than 10% of total waste arrivals onsite. The site will operate a well-marked two-way traffic flow system with a wide turning area at the tipping hall to reduce the potential for vehicle collisions. 25 km/h speed limit on site. Spill procedures will be in place.	4

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
					surface water retention tank outfall. This event would be localised and of short duration.			
1.3	Truck delivering lime, expanded clay or carbon to site	Spills from trucks delivering consumables (<26t) on delivery which could disperse in the atmosphere (these are powders)	Release of lime to hard-standing area. Washed into surface water drainage system resulting in elevated pH levels in surface water runoff.	2	A spill of lime washed into the water drainage system on the site may result in elevated pH levels in the surface water runoff. This would trigger the pH alarm located before the surface water retention tank and runoff can be retained in the firewater retention tank. There will also be an additional alarm at the surface water retention tank outfall. This event would be localised and of short duration.	2	Truck delivery of lime to site will be typically weekly or twice weekly. 25 km/h speed limit will be in place on site. Vendor vetting procedures will be used to ensure reputable vendors are used for deliveries. Spill procedures will be in place. Hauliers and contractors to site will be inducted prior to entry on site and so will be aware of the site rules.	4
1.4	Truck delivering caustic (Sodium hydroxide solution) (jerrycans) or nitric acid (IBC's) to site	Sodium hydroxide (25L) or nitric acid delivery spill (<1m^3)	Release of Sodium hydroxide or nitric acid to hard-standing area. Small quantity washed into surface water drainage system.	2	A spill of caustic or nitric acid washed into the external surface water drainage system on the site may result in reduced or increased pH levels in the surface water runoff. Any significant spill would trigger the pH alarm located before the surface water retention tank and the water would be retained in the fire water retention tank. There	2	Truck deliveries of caustic or nitric acid to site will typically be every 2-4 weeks. 25 km/h speed limit will be in place on site. Vendor vetting procedures will be used to ensure reputable vendors are used for deliveries. Spill procedures will be in place to ensure spills are contained and appropriately disposed of. Hauliers and contractors to site will be inducted prior to entry on	4

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
					will also be an additional pH sensor at the surface water retention tank outfall and once the pH levels are outside of the agreed limits the pump stops discharge. This event would be localised and of short duration. Any spill in the caustic delivery area will be captured in the drainage channel and stored in the recovery tanks.		site and so are aware of the site rules.	
1.5	Truck delivering solid waste (hazardous and non-hazardous)	Solid waste spilled accidently onto hard-standing (<30t)	Solid waste is released to hard-standing area. Contained on site	1	A spill of solid waste to ground would not result in any damage to the environment. Any waste spilled will be collected and placed in the waste bunker. Potential for leachate from solid waste deliveries on the ground if the truck tipped over the kerbing.	2	Waste delivery activities will take place in accordance with the licence conditions. The site will operate a well-marked two-way traffic flow system with a wide turning area for waste delivery vehicles to reduce the potential for vehicle collisions. 25 km/h speed limit will be in place on site. Vetting procedures will be used for waste contractors. Spill procedures will be in place.	2
1.6	Truck carrying liquid waste (non-hazardous and hazardous) to liquid waste unloading area.	Accidental release of non-hazardous liquid waste (up to 30m^3) to hard-standing area which has the potential to release into the surface	Release of non-hazardous liquid waste to surrounding hard-standing area entering the surface water drainage system.	3	Any significant release of liquid waste to the water drainage system on the site will trigger the TOC/pH alarm located before the surface water retention tank. This surface water runoff will then be retained	2	Truck activities (including deliveries of non-hazardous liquid waste) will be typically less than 10% of total waste arrivals onsite. The site will operate a well-marked two-way traffic flow system with a wide turning area at the tipping hall to reduce the	6

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
		water drainage system.			in the fire water retention tank, preventing it reaching any external water bodies. There will also be an additional alarm at the surface water retention tank outfall. This event would be localised and of short duration.		potential for vehicle collisions. 25 km/h speed limit will be in place on site. Spill procedures will be in place.	
1.7	Trucks carrying solidified material from pre-treatment plant	Accidental release of FIBC bags that contain the hardened material. The blocks could break and disperse to the atmosphere	Dispersal of residues into the atmosphere	2	If the material broke up and dispersed into the atmosphere, a modelling exercise would have to take place to see where the bulk of the residues have deposited. If not on hardstanding, this soil would have to be dug up and removed for safe disposal.	1	The speed limit on the site will be <25km/h. Hauliers will be approved and are inducted on site. The FIBC bags will be tied once filled so the material is unlikely to spill out even if broken. There will be an ERT and production staff on site, so any spills/leaks will be cleaned up quickly to prevent dispersion to the environment.	2
2. Tipping Hall								
2.1	General waste load accidentally containing unapproved hazardous waste component enters facility and is placed in waste bunker.	General waste load accidently containing unapproved hazardous waste components enters facility and is placed in the waste bunker. It is then transferred into the hopper and	Unsuitable hazardous waste component enters furnace and is incinerated. Potential increase in licensed emission levels in combustion gases released to atmosphere.	2	All waste that comes to site will be checked visually prior to entry to the bunker. This will help reduce any high concentrations of unapproved hazardous waste entering the incinerator. Combustion gases pass through several treatment steps. Dioxins	2	Prior to waste being accepted on site, the waste will be classified and profiled. It will go through an approval process on the LIMS system and it will be approved by production/process engineer and waste treatment. Only permitted hazardous wastes will be accepted at the site. All waste documentation will be checked at	4

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
		incinerated in the furnace.			removed with two levels of dioxin removal. If licensed emission levels are elevated, additional dosing of consumables will be initiated to reduce emission levels to ensure licensed limits are not breached. Emission control is automated and can be switched to manual in order to control emissions and to ensure compliance with the ELV's		the weighbridge before entering the site. Spot checks of waste will be carried out to ensure only approved hazardous waste is allowed to enter the waste bunker. Grab operator will visually inspect the waste before it is placed in the hopper and can identify any unsuitable hazardous waste items. There will be a waste handling procedure in place and a schedule of internal audits to ensure it is followed. There will always be a tipping hall operator present when waste arrives on site.	
2.2	Radiation detector scanning waste loads for radioactive material entering the facility	Failure of the radiation detector in scanning the waste and radioactive material entering the facility and waste bunker undetected.	Radioactive material being incinerated and released into the atmosphere and contaminating the residues going for off-site disposal/recovery.	2	The radioactive material entering the waste bunker would be a very small source or material from medical care. All sources in Ireland are very well controlled under licences from the Office of Radiological Protection and Monitoring and hospitals advise patients to keep this waste which has the potential to be radioactive for a period of time prior to disposing of it.	1	The radiation detector will scan incoming waste loads to check for radioactive material. If a radioactive source is detected in the waste, depending on the strength and the half-life of the source, it may be isolated and quarantined on site in a quarantine unit, or the EPA Office of Radiological Protection will come to site and remove it. If radioactive materials were burnt it is more likely that the residues produced from the process would be contaminated.	2

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
2.3	Waste entering bunker which is outside the Waste Acceptance Criteria	The waste would enter the hopper and be incinerated. Potential risk of shutdowns due to size reasons or chemical limits being breached i.e. cause a blockage in the hopper or lack of control on emission	Very limited but could be an increase in carbon monoxide results for a period of time if there is a blockage or could affect other parameters depending on the substance	2	There will be a waste acceptance procedure along with waste acceptance criteria. Waste will be checked visually prior to entry to the bunker.	2	Prior to waste being accepted on site, the waste will be classified and profiled. It goes through an approval process on the LIMS system and it will be approved by production/process engineer and waste treatment. Only permitted wastes will be accepted at the site. All waste documentation will be checked at the weighbridge before entering the site. Spot checks of waste will be carried out to ensure only approved waste is allowed to enter the waste bunker. Grab operator will visually inspect the waste before it is placed in the hopper and can identify any unsuitable waste items. There will be a waste handling procedure in place and a schedule of internal audits to ensure it is followed. There will always be a tipping hall operator present when waste arrives on site.	4
3. Storage and mixing of wastes								
3.1	Waste storage bunker	Leak in waste bunker floor leading to leachate entering groundwater beneath the site.	Leachate enters groundwater beneath the site. Potential contamination of groundwater in the area.	3	Potential for leachate to contaminate groundwater beneath site with resulting remediation required.	2	Waste bunker will be designed and built in compliance with European norms or similar.	6

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
					Potential effect on any groundwater in the area.		The bunker wall will be very thick at over 1m of poured concrete and will be water tight. It is anticipated there will be routine groundwater monitoring as part of site's waste licence.	
3.2	Aqueous Waste Storage Tank	Incompatible waste mixed in which could cause a fire or explosion	Fire or explosion on site. Potential for damage to propane cylinder close by which would cause a domino effect. Air quality could be temporarily affected and the area close to the baker tank would need to be monitored to determine if there is any groundwater or soil contamination	3	Potential for short term effect on air quality in the area. The fire/explosion would be short lived. Potential for the ground in the vicinity of the tank to be contaminated and/or have an impact of groundwater quality.	1	The liquid streams that are accepted to site will be tested for a full WAC test prior to being allowed to come to site. Once the tank arrives on site, it will be sampled to determine if it conforms with the original sample from the customer. The tank will not be offloaded until the results show conformity. If the tank does not conform it will be moved offsite for different treatment. The typical waste streams that will be accepted are primarily washings from pharmaceutical companies. There will be very limited solvents present or reactive chemicals, so a reaction or compatibility issue is unlikely.	3
3.3	Road tankers containing liquid (hazardous and non-hazardous) for treatment	Tankers could leak which could enter surface water drainage system	Limited environmental effect. Potential for contaminated surface water	2	The unloading area around the road tankers is contained locally. The liquid would go into the bund and if it gets out of the bund it would be held in the holding tank that is isolated from	1	Indaver's Meath WtE facility have operated an aqueous unloading station for 7 years and have been accepting hazardous waste to it since 2015 with no issues. The same procedures would be put in place at the Cork facility. The	2

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
					the drainage system during unloading operations If there was no change in the limits of TOC, pH or conductivity then the potential for release to the environment is possible, however the material that comes to site generally has organics present and so the TOC would rise and once the analyser reaches the warning limits, the surface water would be retained in the firewater retention tank and will not enter the stormwater attenuation tank which is connected to the storm sewer.		tanks that will be delivered to site will be from approved hauliers and are designed to internationally recognised standards for transport..	
4. Heat treatment of wastes								
4.1	Furnace explosion	Explosion in the furnace e.g. if gas cylinder/petrol can/explosive entered in waste stream or if material is directly injected and causes explosion	Potential damage to furnace. Combustion products would pass through the treatment process. Only an extremely large explosion would potentially breach the walls of the furnace releasing untreated combustion gases to the atmosphere.	3	No release of untreated flue gases to atmosphere while process is shut down. If furnace is ruptured from explosion, combustion gases released to atmosphere without treatment. Process will be shut down. Short duration event with rapid dispersal.	1	Control procedures will be in place to prevent flammable/explosive material wastes entering furnace. This includes waste documentation check at the weigh bridge before entering the site, routine spot checks on waste and grab operator visual inspection of waste before it is placed in the hopper. Furnace will be designed to withstand any small explosions	3

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
							such as a domestic gas cylinder. Prior to liquid waste being injected the tank will be sampled and analysed for conformity. Only after having evaluated the results will a tank be treated on site.	
4.2	Risks associated with emissions due to poor combustion in the incinerator	Generation of excessive/non-conforming combustion gases	Poor combustion may result in excessive emissions or issues with ash quality for disposal	2	Dispersion modelling conducted by AWN in the EIAR indicates that even in the worst-case scenario i.e. where ELVs are exceeded for a short-term period, no ambient air quality standard will be breached by the facility.	1	The incineration technology that will be employed at the facility and the subsequent abatement systems are similar to the now well-established Meath facility and waste streams are well characterised there. It is understood the likelihood of a significant issue in terms of emissions or residue disposal as a result of poor combustion within the incinerator is low.	2
4.3	Burning of Unapproved Waste in the Incinerator	Generation of excessive/non-conforming combustion gases	Combustion of unapproved waste streams may result in excessive emissions or issues with ash quality for disposal	2	Dispersion modelling conducted by AWN indicates that even in the worst-case scenario i.e. where ELVs are exceeded for a short-term period, no ambient air quality standard will be breached by the facility.	2	All waste streams accepted at the facility will be subject to a detailed waste acceptance procedure and it is considered that any significant quantities of unapproved wastes types will be detected and quarantined prior to incineration.	4
5. Ash handling and storage								

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
5.1	Bottom ash wet bath	Release of liquid from bottom ash wet bath.	Potential for released liquid to enter internal drainage system to water recovery tanks.	2	Contaminant potential of water in the bottom ash wet bath is variable and assessment is based on the worst-case scenario with the water being toxic to aquatic organisms with high pH. All water from wet bath would be contained in the water recovery tanks. If the recovery tanks overflow, then the water could get into the surface water drainage system which would go towards the surface water retention tank. Should this occur, due to the high pH it would cause a divert into the fire water retention tank.	1	The wet bath will be designed to be impermeable and fit for purpose. Ongoing maintenance will check structural integrity of the bath and inspection for leaks. The retention tank will run in automatic mode so the divert will occur once the pH is not within trigger limits. Surface water drainage system will be integrity tested.	2
5.2	Boiler ash silo/flue ash silo (located indoors)	Discharge from ash silo (<1t) with no collection truck or FIBC in place, or spill of ash from FIBC	Ash spill to ground. No release to surrounding environment. Potential for some ash to be washed into internal floor drains.	2	Based on the Indaver Meath facility analysis, the boiler ash and flue gas residues are classified as H412 (harmful to the aquatic environment). All ash will be washed into internal drains collected in internal recovery tanks where it will be contained. No release off site.	1	There will be a range of measures and systems in place at the site to minimise the risk of a spill/release of boiler ash and flue gas residue. The system will be a mix of automation but also manual so there is no possibility of the material coming out when there is no truck or FIBC in place. The control room will manage either locally or via CCTV, all dispensing of ash to collection trucks in coordination with	2

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							collection truck driver and dispensing of ash to FIBCs in coordination with operators. The FIBC bags will be tied once filled so the material is unlikely to spill out. Spill containment procedures will be in place for any ash spills.	
5.3	Ash silo otherwise overflowing	Accidental overfilling of silo etc resulting in release of silo contents in surrounding area	Generation of dust or contaminated run off	2	Based on the Indaver Meath's analysis the boiler/flue ash and gas cleaning residues are classified as hazardous. However, even in the event it is unlikely that ash will be mobilised over any distances as overflow will occur within building – limited quantity likely to be spilled before detection.	1	SOP will be in place for silo filling. It is considered that the Distribution Control System (DCS) which will be manned 24/7 by an operator and includes high level and high-level alarms will prevent any overflow. The system will be designed to only operate under control of personnel in control room. Very unlikely to occur.	2
5.4	Bottom ash hall	Dust explosion in bottom ash hall	Emissions to air from the explosion. Release of dust into the atmosphere.	3	There would be a release of emissions from an explosion to atmosphere that should be quickly dispersed. There would also be a release of dust to atmosphere. Modelling would have to be done to determine if ground contamination existed and if it did a clean-up task would ensue.	1	This is not considered likely due to the presence of moisture expected to be present in this area. The dust particles will be quite moist from the bottom ash treatment and there will be good ventilation in the area. There will be limited combustible materials in the area.	3
6. Air emissions treatment process								

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
6.1	Ammonia solution tank	Failure of the ammonia solution tank due to puncture or catastrophic failure (<80m^3).	Release of ammonia solution (H400): Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment) to the hard-standing area and collected in surface run-off system.	2	Any large spill released at the delivery area will enter the surface drains in the area of the tank. It will enter the surface water drainage system where it will pass through the hydrocarbon interceptor. If the pH limit at the monitoring point located after the interceptor is exceeded, the run-off will be contained in the firewater retention tank. There will also be a monitoring point at the outfall from the site which will shut down the discharge pump from the site if the limits set are exceeded. This is a localised and short duration event with any spilled material contained within the surface water drainage system for the site. Should it reach the soil i.e. tank has been punctured and ammonia has spilled to the surrounding soil, the soil will be tested and dealt with accordingly which could include removal from site.	2	The ammonia solution will be contained in a double skinned tank with leak and overfill protection. There will be a maintenance procedure for inspecting pipelines to ensure they are kept in a good condition. Pipeline is carried on a pipe tray over ground to aid leak detection. There will be no flanges on the pipeline as it will be a welded pipe Tank filling will be a manned operation with a written procedure. Spill containment procedures will be in place. ERT will be onsite to deal with any spill or incidents. The tanks will be under a maintenance programme to ensure they are fit for purpose and integrity tested.	4

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
6.2	Ammonia solution tank	Small loss of ammonia solution from tank or pipeline leak.	Release of ammonia solution (H400): Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment) to the hard-standing area and collected in surface run-off system.	2	Small spill released to hard-standing area. The liquid would go into the bund and if it gets out of the bund it would be held in the holding tank that is isolated from the drainage system during unloading operations. Outside of filling operations, any spills enter the surface water collection system. Any significant loss will trigger the pH alarm located before the surface water retention tank and will retained the water in the firewater retention tank. There is also an additional alarm at the storm water retention tank outfall. This event would be localised and of short duration.	2	The ammonia solution will be contained in a double skinned tank with leak and overfill protection. There will be a maintenance procedure for inspecting pipelines to ensure they are kept in a good condition. Pipeline is carried on a pipe tray over ground to aid leak detection. There will be no flanges on the pipeline as it will be a welded pipe Tank filling will be a manned event with a written procedure. Spill containment procedures will be in place. ERT will be onsite to deal with any spill or incidents. The tanks will be under a maintenance programme to ensure they are fit for purpose and integrity tested.	4
6.3	ID fan at stack	Failure of ID fan before the stack	Potential release of odours as process shuts down. Potential for odours from waste bunker as negative pressure is reduced. Combustion gases pass through treatment process.	2	Potential odour release. If there is a problem with the suction fan the process can be quickly shut down.	1	Fan will be designed to last for facility design life. There will be two motors on the suction fan at the stack. This will provide a back-up should a motor fail. Power supply to fan will be backed up by the diesel generator. Service and maintenance schedule for suction fan equipment will be in place. The process will be manned 24/7	2

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
							and so should a problem occur it will be dealt with immediately. Manager on call will be in place. The motor fan and gear box will have online condition monitoring such as temperature and vibration analysis with alarms configured at the DCS.	
6.4	Failure of the Air Abatement System	Release of untreated emissions to atmosphere	Potential effect on sensitive receptors in the environs of the facility (human health, flora and fauna etc.)	1	Dispersion modelling indicates that even in the worst-case scenario i.e. where proposed ELVs are exceeded for a short-term period, no ambient air quality standard will be breached by the facility. Any failure will also be a short-term event.	2	It is considered that short term failures of the abatement system (momentary stoppages etc) may occur from time to time however, Indaver's abatement systems will be comprised of a number of steps to treat the various components of the flue gases and any failure of the system is therefore likely to be partial rather than a complete shutdown of the system. All steps of the treatment process will include duty stand by equipment/alternative process to ensure maintenance of operation of the abatement system.	2
6.5	Release of Unabated Emissions to Atmosphere	Release of untreated emissions to atmosphere	Potential effect on sensitive receptors in the environs of the facility.	1	Dispersion modelling indicates that even in the worst-case scenario i.e. where proposed ELVs are exceeded for a short-term period, no ambient air quality standard will be breached by the facility.	2	It is considered that short term failures of the abatement system (momentary stoppages etc) may occur from time to time however, Indaver's abatement systems will be comprised of a number of steps to treat the various components of the flue gases and any failure of the system is	2

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
					Any failure will also be a short-term event.		therefore likely to be partial rather than a complete shutdown of the system. All steps of the treatment process will include duty stand by equipment/alternative process to ensure maintenance of operation of the abatement system.	
6.6	Impact on Abatement due to extreme cold temperatures	Failure or reduced performance of abatement systems	Potential effect on sensitive receptors in the environs of the facility.	1	Dispersion modelling indicates that even in the worst-case scenario i.e. where proposed ELVs are exceeded for a short-term period, no ambient air quality standard will be breached by the facility. Any failure will also be a short-term event.	2	Indaver's abatement systems will be housed within weatherproof facility buildings and as such is at limited risk of reduced performance due to cold weather etc. Also, heat tracing will be installed where required. Flue gases in flue gas system are typically >140° and so this is unlikely to occur.	2
6.7	Aqueous Waste Tank	Failure of the aqueous waste tank due to puncture or catastrophic failure (<250m^3).	Release of aqueous waste to the hard-standing area and collected in surface run-off system.	2	Any large spill released at the delivery area will enter the surface drains in the area of the tank. It will enter the surface water drainage system where it will pass through the hydrocarbon interceptor. If the pH limit at the monitoring point located after the interceptor is exceeded, the run-off will be contained in the firewater retention tank. There will also be a monitoring point at the outfall from the site which	2	The aqueous waste will be contained in a double skinned tank with leak and overfill protection. There will be a maintenance procedure for inspecting pipelines to ensure they are kept in a good condition. Pipeline is carried on a pipe tray over ground to aid leak detection. There will be no flanges on the pipeline as it will be a welded pipe Tank filling will be a manned event with a written procedure. Spill containment procedures will be in place. ERT will be onsite to deal with any spill or incidents.	4

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
					will shut down the discharge pump from the site if the limits set are exceeded. This is a localised and short duration event with any spilled material contained within the surface water drainage system for the site. Should it reach the soil i.e. tank has been punctured and aqueous waste has spilled to the surrounding soil, the soil will be tested and dealt with accordingly which could include removal from site.		The tanks will be under a maintenance programme to ensure they are fit for purpose and integrity tested.	
6.8	Aqueous Waste Tank	Small loss of aqueous waste from tank or pipeline leak.	Release of aqueous waste to the hard-standing area and collected in surface run-off system.	2	Small spill released to hard-standing area. The liquid would go into the bund and if it gets out of the bund it would be held in the holding tank that is isolated from the drainage system during unloading operations. Outside of filling operations, any spills enter the surface water collection system. Any significant loss will trigger the pH alarm located before the surface water retention tank and will retained the water in the	2	The aqueous waste will be contained in a double skinned tank with leak and overfill protection. There will be a maintenance procedure for inspecting pipelines to ensure they are kept in a good condition. Pipeline is carried on a pipe tray over ground to aid leak detection. There will be no flanges on the pipeline as it will be a welded pipe Tank filling will be a manned event with a written procedure. Spill containment procedures will be in place. ERT will be onsite to deal with any spill or incidents.	4

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
					firewater retention tank. There is also an additional alarm at the storm water retention tank outfall. This event would be localised and of short duration.		The tanks will be under a maintenance programme to ensure they are fit for purpose and integrity tested.	
6.9	Aqueous waste Tank	Incompatible waste mixed in which could cause a fire or explosion	Fire or explosion on site. Potential for damage to propane cylinder close by which would cause a domino effect. Air quality could be temporarily affected and the area close to the aqueous waste storage tank would need to be monitored to determine if there is any groundwater or soil contamination	3	Potential for short term effect on air quality in the area. The fire/explosion would be short lived. Potential for the ground in the vicinity of the tank to be contaminated and/or have an impact of groundwater quality.	1	The liquid streams that are accepted to site will be tested for a full WAC test prior to being allowed to come to site. Once the tank arrives on site, it will be sampled to determine if it conforms with the original sample from the customer. The tank will not be offloaded until the results show conformity. If the tank does not conform it will be moved offsite for different treatment. The typical waste streams that will be accepted are primarily washings from pharmaceutical companies. There will be very limited solvents present or reactive chemicals, so a reaction or compatibility issue is unlikely. Nitrogen blanketing will be in place to keep the oxygen level in the tank as low as possible.	3

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
7. Fires and fire water								
7.1	Contractors' Workshop fire	Major fire in contractors' workshop building leading to destruction of materials stored and release of smoke. Generation of fire water	Combustion products to atmosphere. Fire water to drainage.	2	Firewater containment on-site. Once fire alarm is activated, the control room will shut off the outfall pump and all fire water will be diverted to the fire water retention tank. Combustion products are quickly dispersed and diluted and will be short duration once fire is extinguished. Smoke released to atmosphere. There is no potential for ground and groundwater contamination as there is hardstanding in this area.	1	There will be a comprehensive fire protection system at the site to minimise the risk of a fire. It will include an Emergency Response Procedure & training/induction requirement for staff, sprinkler systems, fire detection and alarm systems, hose reels and fire hydrants/extinguishers. Spill containment procedures will be in place for any release of flammable materials.	2
7.2	Major fire within waste storage area or incineration process	Release of fire water and/or foam following a major fire in a waste storage or processing area of the site.	Potential generation of contaminated fire water, which would be retained either locally (where the fire occurred) or within the surface water drainage system, including the fire water retention tank and the internal surface water recovery tanks. A small quantity of fire water may enter the ground if released onto a non-hard-standing area.	3	Minor impact from the generation of fire water, the in-situ treatment of contaminated firewater and/or clean up in-situ of hard-standing areas. The EIAR completed concluded that there will be sufficient retention capacity for fire water at the site. Fire water can also be contained in the waste bunker. The fire alarm will trigger the diversion of run-off to the	1	There will be a comprehensive fire protection system at the site to minimise the risk of a fire. It will include an Emergency Response Procedure with training/induction requirements for staff, sprinkler systems, a fire detection and alarm system, hose reels and adjacent fire hydrants/ extinguishers. Spill containment procedures will be in place for any release of flammable materials.	3

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
					firewater retention tank. All external surface water run-off passes through a Class 1 full retention hydrocarbon interceptor.			
7.3	Major fire within waste storage area or incineration process	Potential for release of smoke and combustion gases to the atmosphere.	Release of smoke to the atmosphere and dispersion with no long-term damage to the environment.	3	No long-term environmental impact but smoke may be a nuisance in the short term or over the duration of the fire.	1	There are a range of measures and systems in place at the site to minimise the risk of a fire, including safety procedures, appropriate storage of flammable and combustible materials, a site-wide fire alarm system, smoke detectors, fire hydrants and fire-fighting equipment (extinguishers and water cannons). Spill containment procedures are in place for any release of flammable materials. The site will also have a dedicated ERT team on site to deal with fires. The ERT team will all be fully fire trained. A range of fire systems will be in place: 1) UV/IR Flame/fire detectors 2) Aspiration systems 3) Smoke detectors.	3
7.4	Waste bunker storage	Major fire in the waste bunker	Release of combustion gases to air without	3	Release of untreated combustion gases and smoke to atmosphere. All fire water will be contained	2	Waste bunker will be visually monitored, and any localised fires will be removed using the grab. Water cannons will be in place in	6

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
		leading to generation of fire water.	treatment. Generation of firewater.		in the waste bunker. Short duration event with rapid dispersion. Pumping out of bunker and firewater retention tank.		the waste bunker designed to suppress fires in the waste. Water cannons can be controlled from the control room to target exact locations of fires. There will be UV/IR combined fire detectors in the waste bunker to detect any fires in the waste.	
7.5	Trucks arriving to site on fire	Waste from the supplier may be on fire due to burning embers or ignition of the waste by the fermentation process	Release of combustion gases to air without treatment. Generation of firewater.	3	Release of untreated combustion gases and smoke to atmosphere. Short duration event with rapid dispersion. All fire water will be contained in either the bunker or will go to the surface water drainage system and once the limits at the incoming TOC are triggered it will be retained in the fire water retention tank. Pumping out of bunker and firewater retention tank. Waste might cause a larger fire if enters the bunker and is not noticed.	1	Waste bunker will be visually monitored, and any localised fires will be removed using the grab. Water cannons will be in place in the waste bunker designed to suppress fires in the waste. Water cannons can be controlled from the control room to target exact locations of fires. There will be UV/IR combined fire detectors in the waste bunker to detect any fires in the waste.	3
8. Ancillary Services								
8.1	Diesel tank storage	Diesel tank failure/puncture and potential release of	Release of oil to surface water run-off system.	3	This will be a localised and short duration event with any spilled fuel contained within the surface water	1	Very low probability of tank failure. Tank will be double skinned with leak and overfill protection. Tank filling operation	3

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
		up to 60m^3 of diesel to ground.			drainage system for the site. If the diesel tank ruptures, then there is potential for groundwater and soil contamination. This would be a localised situation. Any spill released at the unloading area will enter the surface drains in the area of the tank which is equipped with a forecourt separator. If the release is above the capacity of the separator it will enter the surface water drainage system where it will pass through the class 1 full retention hydrocarbon interceptor where additional diesel will be contained. If the TOC limit at the monitoring point located after the interceptor is exceeded, the run-off will be retained in the firewater retention tank. There will also be a monitoring point at the outfall from the site.		will be managed and supervised. Low numbers of vehicle movements expected in the area. There will be a tank inspection schedule in place in the maintenance plan for the site.	
8.2	Generator diesel tank storage	Diesel tank failure and release of up to	Release of oil to surface water run-off system	3	This will be a localised and short duration event with	1	Very low probability of tank failure. Tank will be double	3

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
		approximately 7m^3 of diesel to ground.			any fuel spilled contained within the surface water drainage system for the site. Any oil spill entering the surface water drains will enter the water drainage system and will pass through a class 1 full retention hydrocarbon interceptor, where oil will be contained, before entering the surface water retention tank. If the TOC limit at the monitoring point located after the interceptor is exceeded, the run-off will be retained in the firewater retention tank. There will also be a monitoring point at the outfall from the site		skinned and regularly maintained and inspected as part of the general site maintenance. Fall of the ground would direct the contamination to surface water drainage system where it will be detected on the TOC analyser and diverted to a firewater retention tank. This reduces the possibility for loss outside of the site.	
8.3	Domestic effluent treatment process	Failure of domestic effluent treatment system or release of untreated domestic type effluent to groundwater.	Improperly treated domestic type effluent enters groundwater at the site.	2	Contamination of groundwater in local vicinity with domestic type effluent from offices. Potential to affect any groundwater in the vicinity of the site.	2	Domestic waste water system will discharge to the foul network point at the eastern part of Ringaskiddy Village.	4
8.4	Transformer compound	Release of up to 8.4 tonne of transformer	Any oil released from transformer enters the bund and is contained.	3	All oil will be contained in the bund. Bund will be sized to contain 110% of oil	2	Transformer will be designed to contain oil. Bunding prevents any release of oil and will be maintained/tested as part of the	6

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
		oil (PCB free) to bund.			contents. All oil will be PCB free.		site's ongoing maintenance programmes.	
8.5	Transformer compound	Potential release of SF6 gas	The amount of SF6 gas has a global warming potential of c.68 tonnes of CO_2	1	There is 4 x 0.527kg units and 4 x 0.225kg units so 3.008kg of SF6 gas on site which has the global warming potential of ~68T of CO_2.	1	This material is inert. The only cost would be the Emissions Trading Scheme implications.	1
9. Other Risks (including Generic Risks)								
9.1	Flooding on site causing uncontrolled damages	Floodwaters entering process buildings area or causing damage to process/utility equipment, pipeline or tank damage.	Contamination of soil, groundwater and potential knock on consequences for facility operation, emissions and residue management etc.	2	In the event of a major flood event at the facility (>1 in 100-year event), the facility paving has been designed to divert flood water away from the building towards the existing drainage network. This should minimise the consequences of any major flood event.	2	The possibility of a major flood event occurring at the site is considered very low due to the raised site levels and the additional off-site stormwater attenuation capacity provided as part of the L2545 road upgrade works.	4
9.2	Failure of the surface drainage water network, causing releases to ground.	Loss of potentially contaminated surface water to ground.	Contamination of soil and bedrock aquifer.	2	All waste handling etc. will be carried out within the process buildings and as a result surface water drainage at the facility will generally be uncontaminated. Any release of mildly contaminated surface water run-off via a drain failure is	2	The likelihood of a failure of the drainage network over the lifetime of the facility is medium.	4

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
					likely to have minimal consequences.			
9.3	Activities of Contractors causing release of materials to atmosphere, surface water, groundwater, noise, dust etc.	Generation of environmental nuisances as a result of contractor's activities.	Air emission (dust or other particulate matter) or contamination of soil, groundwater or surface water	2	Contractors working on site will be carefully chosen and vetted by Indaver to ensure their activities are carefully managed and any potential impacts minimised. Any releases of materials to atmosphere, soil or water will likely be small scale therefore consequences are likely to be at lower end of the range.	2	Having carefully vetted all contractors used on site, it is considered that the likelihood of any loss of a significant amount of hazardous substances is low to moderate. No work will commence before the job owner has reviewed and agreed on the method statement and risk assessment. Permit to work procedures are in place.	4
9.4	Failure of the retention tank to contain storm water or fire water	Overflow of tank	Releases of tank contents to the ground	2	Water in the tank will likely be within its discharge limits as otherwise the water would have been diverted to the fire water retention tank. In the rare case of their being a fire and the water backflows into the tank, then it could be released and be over the required trigger levels.	2	The tanks will be continuously monitored for compliance with the trigger levels.	4
9.5	Failure of the foul sewer drainage system	Leak of foul waste into the ground and ultimately into the groundwater	Release of waste foul material to the groundwater system	2	The site will be on a regionally important aquifer and any pollution over ground could cause damage. The impact of leaks from effluent drains would be localised as the	2	Domestic waste water system will discharge to the foul network point at the eastern part of Ringaskiddy Village.	4

Risk ID	Area	Potential Risk	Environmental Effect	(C) Rating	Basis of Rating	(L) Rating	Basis of Rating	Risk Score
					overburden comprises variable thickness of clay. The soil layer thickness varies across the site, ranging from 0.3m deep in the centre of the site to 10m depth near the east.			

Table 4.3 *Assessment of Environmental Risks*

4.1 Risk Evaluation

Table 4.4 presents the assessed risks from Table 4.3 in ranked order based on risk score to assist in prioritisation for risk treatment process.

Risk ID	Location	Potential Risk	(C x L) Risk Score
1.6	Truck carrying liquid waste (non-hazardous) to liquid waste unloading area.	Accidental release of non-hazardous liquid waste (up to 30m^3) to hard-standing area.	6
3.1	Waste storage bunker	Leak in waste bunker floor leading to leachate entering groundwater beneath the site.	6
7.4	Waste storage bunker	Major fire in the waste bunker leading to generation of fire water.	6
8.4	Transformer compound	Release of up to 8.4 tonne of transformer oil (PCB free) to bund.	6
1.1	Truck movements around the site including waste and supply deliveries.	Release of diesel from a truck fuel tank or similar vehicle (< 500 litres) due to crash, accident, or overfill/non-closure of fuel tank.	4
1.2	Truck carrying sludge waste to waste bunker.	Accidental release of sludge waste (up to 30m^3) to hard-standing area.	4
1.3	Truck delivering lime to site	Lime spill (<26t) on delivery	4
1.4	Truck delivering Caustic (jerrycans) or nitric acid (IBCs)to site	Caustic or nitric acid delivery spill (<1m^3)	4
2.1	General waste load accidentally containing unapproved hazardous waste component enters facility and is placed in waste bunker.	General waste load accidently containing unapproved hazardous waste components enters facility and is placed in the waste bunker. It is then transferred into the hopper and incinerated in the furnace.	4
2.3	Waste entering the bunker which is outside the waste acceptance criteria	The waste would enter the hopper and be incinerated. Potential risk of shutdowns due to size reasons or chemical limits being reached i.e. cause a blockage in the hopper or lack of control on emissions	4
4.3	Burning of unapproved material in the incinerator	Generation of excessive/non-conforming combustion gases	4
6.1	Ammonia solution tank	Failure of the ammonia solution tank due to puncture or catastrophic failure (<60m^3).	4
6.2	Ammonia solution tank	Small loss of ammonia solution from tank or pipeline leak.	4
6.7	Aqueous waste tank	Failure of the aqueous waste tank due to puncture of catastrophic failure (<250m^3)	4
6.8	Aqueous waste tank	Small loss of aqueous waste from tank or pipeline leak.	4
8.3	Domestic effluent treatment process	Failure of domestic effluent treatment system or release of untreated domestic type effluent to groundwater.	4
9.1	Flooding on site causing uncontrolled damages	Floodwaters entering process areas or causing damage to process, utility equipment, pipeline, or tank damage	4
9.2	Failure of the surface water drainage network, causing release to ground	Loss of potentially contaminated surface water to ground	4

9.3	Activities of contractors causing release of materials to atmosphere, surface water, groundwater, noise, dust etc.	Generation of environmental nuisances or contamination of soil, groundwater, or surface water as a result of contractor's activities	4
9.4	Failure of the pond to contain storm water or fire water	Overflow of pond or wave creation in pond	4
9.5	Failure of the foul sewer drainage system	Leak of foul waste into the ground and ultimately into the groundwater	4
3.2	Aqueous Waste Storage tank	Incompatible wastes mixed in which could cause fire or explosion	3
4.1	Furnace explosion	Explosion in the furnace e.g. if gas cylinder/petrol can/explosive entered in waste stream or if material is directly injected and causes explosion	3
5.4	Bottom ash hall	Dust explosion in bottom ash hall	3
7.2	Major fire within incineration process	Release of fire water and/or foam following a major fire in a waste storage or processing area of the site.	3
7.3	Major fire within incineration process	Potential for release of smoke to the atmosphere.	3
7.5	Trucks arriving to site on fire	Waste from the supplier may be on fire due to burning embers or ignition of the waste by the fermentation process	3
8.1	Diesel tank storage	Diesel tank failure/puncture and potential release of up to 44m^3 of diesel to ground.	3
8.2	Generator diesel tank storage	Diesel tank failure and release of up to 9m^3 of diesel to ground.	3
1.5	Truck delivering solid waste (hazardous and non-hazardous)	Solid waste spilled accidently onto hard-standing (<30t)	2
1.7	Trucks carrying solidified material from pre-treatment plant	Accidental release of FIBC bags that contain the hardened material. The blocks could break and disperse to the atmosphere	2
2.2	Radiation Detector scanning waste loads for radioactive material entering the facility	Failure of radiation detector in scanning the waste and radioactive material entering the facility and waste bunker undetected.	2
3.3	Road Tankers containing liquid (hazardous and non-hazardous) for treatment	Tankers could leak which could enter surface water drainage system	2
4.2	Risks associated with emissions due to poor combustion in the incinerator	Generation of excessive/non-conforming combustion gases	2
5.1	Bottom ash wet bath	Release of liquid from bottom ash wet bath.	2
5.2	Boiler ash silo/flue ash silo (located indoors)	Discharge from ash silo (<1t) with no collection truck or FIBC in place, or spill of ash from FIBC	2
5.3	Silo otherwise overflowing	Accidental overfilling of silo etc resulting in release of silo contents in surrounding area	2
6.3	ID fan at stack	Failure of ID fan before the stack	2
6.4	Failure of the air abatement system	Release of excessive air emissions to atmosphere	2
6.5	Release of unabated emissions to atmosphere	Release of excessive air emissions to atmosphere	2
6.6	Impact on abatement due to extreme cold temperatures	Failure or reduced performance of abatement systems	2
7.1	Contractors' workshop fire	Fire in contractors' workshop leading to destruction of materials stored and release of smoke. Generation of fire water	2
8.5	Transformer Compound	Potential release of SF6 Gas	1

Table 4.4 *Identified risks ranked in terms of risk score*

A Risk Matrix has been developed to display the risks visually with colour coding to give an indication of the critical nature of each risk. The risk scores of each of the identified risks from Table 4.3 and Table 4.4 are presented on the risk matrix in Table 4.5 (referenced by the Risk ID).

LIKELIHOOD						
Very High	5					
High	4					
Medium	3					
Low	2	1.5, 6.4, 6.5, 6.6	1.1, 1.2, 1.3, 1.4, 2.1, 2.3, 4.3, 6.1, 6.2, 6.7, 6.8, 8.3, 9.1, 9.2, 9.3, 9.4, 9.5	1.6, 3.1, 7.4, 8.4		
Very Low	1	8.5	1.7, 2.2, 3.3, 4.2, 5.1, 5.2, 5.3, 6.3, 7.1	3.2, 4.1, 5.4, 7.2, 7.3, 7.5, 8.1, 8.2		
		Trivial	Minor	Moderate	Major	Massive
		1	2	3	4	5

CONSEQUENCE

Table 4.5 *Risk matrix for Indaver facility (numbers in shaded cells are Risk IDs)*

The risk matrix indicates that there are no potential risks in the red or amber zone.

All other risks are located in the green zone which indicates the need for continuing awareness and monitoring on a regular basis. However, assessment of the risks has indicated that the risk score of a number of these risks can be reduced through the implementation of mitigation measures. These risk mitigation measures will be adopted where considered cost-effective and appropriate.

5.0 RISK TREATMENT

The output of the risk treatment process is the development of a statement of measures to be taken to minimise the environmental risk of the activity. The facility has been designed and intends to operate to minimise risk in every aspect of its operations.

Though suitable hazardous waste streams will be accepted at the facility, the same mitigation measures will be in place to ensure the risk of an accident or environmental incident at the site is minimised.

On the basis of the risks identified above a statement of measures is provided below for risk ID 7.4 as it has the potential to incur greatest financial liability. All other risks will be suitably mitigated by the controls to be in place at the proposed facility.

Each mitigation measure for a major fire in the waste bunker has been listed. Indaver intends to review its statement of measures regularly in accordance with the onsite schedule basis and identify additional risk reduction measures where possible.

Risk ID	Area	Potential Risk	Risk Score	Mitigation Measures to be Taken	Outcome	Action	Completion Date	Responsible Person
7.4	Waste Storage Bunker	Major fire in the waste bunker leading to generation of fire water	6	Strict waste acceptance procedures and checks on waste being accepted to the site. Any localised fires will be removed using the grab. Waste bunker will be visually monitored, and any localised fires will be removed using the grab. Water cannons will be in place in the waste bunker designed to suppress fires in the waste. Water cannons can be controlled from the control room to target exact locations of fires. There will be UV/IR combined fire detectors in the waste bunker to detect any fires in the waste.	Cessation of waste activities and pollution from fire event	Clean up, environmental monitoring and ongoing review	Ongoing	Site Operator

Table 5.1 *Statement of risk mitigation measures*

6.0 IDENTIFICATION OF PLAUSIBLE WORST-CASE SCENARIO

The ELRA for this facility hasn't identified any risks with major consequences.

There were four risks scenarios identified with moderate consequences with a low likelihood. These were Risk ID No.'s *1.6 (Accidental release of non-hazardous liquid waste (up to 30m3) to hard-standing area.), 3.1 (Leak in waste bunker floor leading to leachate entering groundwater beneath the site), 7.4 (Major Fire in the Waste Bunker leading to generation of Firewater)* and *8.4 (Release of up to 8.4 tonne of transformer oil (PCB free) to bund.).*

It is considered that Risk ID 7.4, *Major Fire in the Bunker leading to generation of firewater,* has the potential to incur greatest financial liability. The other risk ID's listed above also have the potential to incur significant clean-up/remediation costs however on balance it is considered that Risk ID 7.4 will incur greater costs.

The EPA guidance advises that the plausible worst-case scenario should be determined based on the highest environmental consequence and does not account for likelihood. Table 7.1 overleaf presents the likely costs for Risk ID 7.4.

7.0 QUANTIFICATION AND COSTING

The plausible worst-case scenario, identified as Risk ID No. *7.4 (Major Fire in the Waste Bunker leading to generation of Firewater)*, has been quantified and costed in Table 7.1.

As this is a new facility which has not yet been constructed, estimates have been made based on the Indaver Waste-to-Energy facility in Meath which has a similar design. The costing sheet will be updated following detailed design of the proposed facility in Ringaskiddy.

Description	Quantity	Measurement Unit	Unit Rate (€)	Cost (€)	Source of Unit Rates
Fire Service Attendance at Site – 1 day (Note 1)	1	Day	€720/hr per tender	69,120	Indaver Estimate and information from fire service
Allowance for testing of Firewater (Note 2)	3	Unit	1,000	3,000	AWN Consulting Estimate
Disposal of Firewater (rate applied is for disposal of contaminated firewater unsuitable for local WWTP treatment due to hazardous waste content) including transport.	2,200	Cubic meters	240	528,000	Indaver Waste treatment department
Removal off site of Fire Damaged Materials – not suitable for incineration (Note 3)	8,000	Tonnes	300	2,400,000	Indaver Waste treatment department
Environmental Consultancy and monitoring post fire to confirm extent of impact (Air Quality Assessment and Dispersion Modelling; Groundwater and Surface Water monitoring)	1	Report	25,000	25,000	AWN Consulting Estimate
Environmental Air Quality Monitoring	100	Samples	175	17,500	AWN Consulting Estimate
Utility Costs: Electricity (Note 4)	19MWh/day	MWh	65	17,309	Taken from CRAMP closure costs
Utility Costs: Water	14	Day	12	168	Taken from CRAMP closure costs

Equipment hire- vacuum tanks (To clean out drains, pipelines, bunker hardstand, fire water retention tank etc)	14	Day	1,300	18,200	Taken from CRAMP closure costs
Equipment hire-Crane with grab	14	Day	1,500	21,000	Indaver Maintenance Team
Diesel for auxiliary burners for controlled shutdown	16,000	L	0.65	10,400	Taken from CRAMP closure costs
Management and Security Costs	2	Weeks	53,615	107,230	Taken from CRAMP closure costs and budget cost for full site staffing for 2 weeks
Combustion gases to air without treatment (costs for assessing impact and remediation if necessary) (Note 5)	1	Report	15,000	15,000	AWN Consulting Estimate
Structural Assessment of the Bunker (Note 6)	1	Report	7,000	7,000	Indaver Quotation by Structural Engineer
Contractor demolition -Crane hire (300T crane plus 100T crane to set up the 300T one)	14	Days	2,400	33,600	Indaver Estimate
Demolition and removal of any metal structures over or within the bunker (steel/aluminium/cabling/insulation etc (Contractor Costs) (Note 7)	14	Days	13,385.71	187,400	Independent Cost Survey
Clean up of site surrounds from fire, internal cleaning also	14	Days	1,152	16,128	Indaver Contractor costs

Total (€)				3,476,055	
Contingency at 25% (€)				869,014	
Total Inc. contingency (€)				4,345,069	

Table 7.1 Costing for Worse-Case Scenario

Note 1: It is understood that there will be sufficient water available on site to fight a 2-hour fire without the need for external fire service attendance (this will be an insurance / bond requirement). However, for the purposes of a conservative assessment as assumption has been made that up to 4 stations @ €720/tender/hour for 1 day (24 hours) may be required should the fire services attend site. Calculation is 4*24*720 = €69,120. This calculation is based on a similar Indaver facility in Meath.

Note 2: Fee for testing includes for collection of sample and analysis of sample for suitable suite on rapid turnaround to avoid any potential delay in commencing pumping and disposal of the firewater.

Note 3: Indaver have considered the potential for wastes unsuitable for incineration arising during a major fire scenario. It is considered that based on the nature of the wastes within the Meath facility, the wastes within the bunker at the Ringaskiddy facility would be suitable for incineration following a fire (It is anticipated that much of the waste within the bunker, particularly waste at the base of the bunker will not burn due to lack of oxygen). It is also anticipated that the building roof, walls, etc that may be damaged during a fire will also be suitable for incineration. In another plant, where a fire in the bunker occurred, the majority of the waste was left after the fire and treated as normal through the incineration process using mobile cranes to move material into the hopper area. Any metal structures over or within the bunker (cranes, crane rails, power cables, sprinkler pipework) that are fire damaged will also be incinerated (to remove any coatings etc) and post incineration the remainder will be sent through the ferrous/non-ferrous process. For the purposes of a conservative assessment an allowance for up to 8,000 tonnes (@€300/tonne) for fire damaged wastes has been made as this is the maximum capacity of the waste bunker.

Note 4: Estimated at 14 days usage using 19MWh per day (average daily usage used based on Meath facility). Cost has come from Indaver's accounts team. Average price for 2018 was €65.07 per MWh.

Note 5: An impact assessment and remediation report would consist of an assessment of monitoring result and determination of what remediation measures will be required, if any.

Note 6: Indaver considered the potential consequences of a major fire on the structural integrity of the bunker at the Meath facility and concluded, given the construction and design of the bunker, that the bunker will remain intact even in the worst-case fire scenario. The same has therefore been assumed for the Ringaskiddy facility which has a similar design. The bunker floor will be 1.5m thick and the walls will be 1m thick. The concrete of the floor will be installed by continuous pour to ensure no structural weaknesses etc. It is anticipated that there will be no need for any demolition or relining of the bunker following a fire. For the purposes of a conservative assessment, an allowance has been made for a post fire structural integrity assessment to confirm the bunker remains intact.

Note 7: An independent study was completed for the site in relation to demolition costs for the Meath facility. For the Meath facility it was assumed that the overall cost is €937,000 and the bunker roof is approximately 20% of the area so a cost of €187,400 applies. The same has been applied to the Ringaskiddy facility as a conservative estimate.

8.0 CONCLUSION

A preliminary environmental liabilities risk assessment (ELRA) has been completed for the activities intended to be carried out at the Indaver Ireland Limited Cork WtE facility in accordance with current EPA guidance.

The potential environmental liability cost has been based on the risk that poses the plausible worst-case scenario. This is the maximum liability that may be incurred and, as such, financial provision is calculated as €4.345M based on this event.

The Indaver Group holds environmental liability insurance which provides for cover for pollution legal liability, contractor's pollution liability, on site clean-up, third party claims for off-site clean-up, third-party claims for bodily injury and property, biodiversity damage and transportation liability. A copy of the insurance policy is enclosed in Appendix B.

However, Indaver proposes to use a bond as Financial Provision and intends to discuss same with the Agency.

Risk management at Indaver is a dynamic process and will be revised through the addition of new risks or the omission of redundant risks. The financial provision will be reviewed in accordance with the requirements of the facility licence to ensure that it continues to cover the environmental liabilities.

Figure 1 – Site Location

See drawing CD5001-Site Location.

Figure 2 – Site Layout

See drawing CD5002-Site Plan.

Figure 3 – Air Emissions and Monitoring Locations

See drawing CD5005-Major Air Emission Points

Figure 4 – Surfacewater Emissions and Monitoring Locations

See drawing CD5013-Drainage Plan.

Figure 5 - Location of Principal Chemical and Waste Storage Areas

See drawing CD5009-Chemical & Waste Storage.

Appendix A – Inventory of Chemicals stored On-site

Ref. No. or Code	Material/ Substance	CAS Number	Danger Category	Amount Stored (tonnes)	Annual Usage (tonnes)	Nature of Use	Hazard Statement
1	Ammonia Solution (25% v/v)	1336-21-6	Skin Corr. 1B, Aquatic Acute 1	80 m3	832	Neutralise the NOx present in the flue gas	H314, H400
2	Diesel	94114-59-7	Carc. 2	60 m3	300	Control heating/cooling of the furnace	H350, H351
3	Sodium Hydroxide (30% v/v)	1310-73-2	Skin Corr. 1A	0.15 m3	32	Stabilise the pH of the boiler drum	H314
4	Nitric Acid (27%)	7697-37-2	Ox. Liq. 2, Skin Corr 1B	3 m3	5.7	Pipework and atomiser cleaning	H272, H314
5	Sodium Chloride	7647-14-5	-	4 tonnes	2	De-icing	-
6	Quicklime (95%)	1305-78-8	-	115 m3	2432	Neutralisation of the acids in the flue gas	-
7	Hydrated Lime	1305-78-8	-	150 m3	0	Neutralisation of the acids in the flue gas	-
8	Activated Carbon	931-328-0	-	80 m3	128	Adsorption of dioxins/furans in the flue gas	-
9	Expanded Clay	-	-	80 m3	160	Adsorption of dioxins/furans in the flue gas	-
10	Ethylene Glycol	107-21-1	Acute Tox. 4	12 m3	25L	Cooling circuits	H302
11	Propane	-	Flam. Gas 1	22 x 18-50 kg	5	Oil burners for start up; forklifts	H220
12	Waste Feed	-	-	7111 tonnes	< 240000	Waste	-
13	Bottom Ash	-	-	600 tonnes	52664	Waste	-
14	Boiler Ash	-	-	122 m3	2000	Waste	-
15	Flue Gas Residue	-	-	476 m3	9104	Waste	-
16	Recovered Ferrous Metal	-	-	100 tonnes	2400	Waste	-
17	Non Ferrous Metal	-	-	25 tonnes	240	Waste	-
18	Waste Oils	-	-	1000L	500L	Waste	-
19	Interceptor Residue	-	-	5m3	1m3	Waste	-
20	WEEE	-	-	<25 tonnes	4	Waste	-
21	Miscellaneous Hazardous	-	-	1 tonne	1	Waste	-
22	Solidified Residues	-	-	100 tonnes	20000	Waste	-
23	Liquids for injection	-	-	220 tonnes	Depending on waste feed (sum will not exceed 240,000t)	Waste	-
24	Acetone	67-64-1	-	25L	0	not used	-
25	ANTI-FREEZE COOLANT ELF FINOL 20 LTR	-	-	20L	10L	Production	-
26	Buffer Solution pH 4	-	-	4 x 1L	3L	Pond	-
27	Buffer Solution pH 7	-	-	4 x 1L	3L	Pond	-
28	Chilltech (corrosion inhibitor in the cooling water sytstem)	-	-	4 x 25L	50L	Production	-
29	Conductivity Standard 1413uS/cm	-	-	4 x 500ml	3L	Pond	-
30	Disinfectant FAM 30 5L	-	-	3 x 5L	20L	Production	-
31	GREENOX Adblue (Urea)	57-13-6	-	4 x 20L	200L	Production	-
32	LUBRICANT BRILUBE 30 (20L)	-	-	2 x 20L	60L	Lubricant	-
33	LUBRICANT QUAKER 888-46 F/R 180KG	-	-	3 x 208L	624L	Furnace and flue gas hydraulics	-

34	Methanol	67-56-1	-	25L	0	not used	-
35	OIL MOBIL DTE26 (208L)	-	-	208L	832L	Lubricant	-
36	Pedrogen (Hydrogen Peroxide Solution)	7722-84-1	Acute Toxicity, Irritant, Aquatic Chronic	1L	500mL	Mech	H302, H318, H413
37	Phosphoric Acid	7664-38-2		4 x 25L	450L	Water Tech (E&I)	H314
38	REAGECON BUFFER SOL.TOC100 100PPM-500MLS	-	-	2 x 500ml	4L	Pond	-
39	RoClean 12	-	-	3 x 1kg	3kg	Mech	-
40	RoClean 2	77-92-9	Irritant (Eye Irritant 2)	3 x 500g	2kg	Mech	H319
41	SODIUM BISULPHATE SOLUTION (25L DRUM)	-	-	25L	0	not used	-
42	Sodium Hydroxide 22%	-	-	5L	2.5L	CEMS multigas analyser	-
43	Sodium Persulphate	7775-27-1	-	4 x 25L	425L	Pond	-
44	Testomat 2000	-	-	3 x 500ml	2L	Hardness Monitoring	-
45	Thermbond	-	-	4 x 1 gallon	1 gallon	Used for maintenance of the furnace during shutdown	-
46	Toluene	108-88-3	Flammable, Irritant, STOT, Aspiriation, Tox., Toxic for Reproduction	25L	0	Not used	H225, H315, H304, H336, H373, H361d
47	Caustic Liquor	-	-	2 x 25L	0	Production	-
48	CAT Transmission and Drive Train Oil	-	-	20L	20L	Loader	-
49	CAT Hydraulic Oil	-	-	3 x 20L	40L	Loader	-
50	CAT Extended Life Coolant	-	-	20L	20L	Loader	-
51	CAT Engine Oil	-	-	20L	20L	Loader	-
52	Karcher Machine Protector Advance 1	-	-	5 x 1L	5L	Loader	-
53	Karcher Active Cleaner	-	-	1L	4L	Loader	-
54	Disofil 32 Refractory Binder	-	-	37 x 5L	0	not used	-
55	Carter SY 220	-	-	2 x 20L	80L	Shutdown	-
56	Ecocool 420 (Slugger Metal Working Fluid)	-	-	5L	2.5L	Coolant for bandsaw	-
57	Lubricant/Coolant for Bredel Hosepump	-	-	3 x 5L	100L	Lubricant for hose	-
58	MOBIL CHASSIS GREASE LB2	-	-	15L	0	Chassis grease	-
59	MOBIL DTE 26	-	-	2 x 208L	416L	Oil for the grab	-
60	Mobil SHC 630	-	-	20L	40L	Grease for grate	-
61	MOBIL XMP 220	-	-	2 x 20L	40L	Gearboxes	-
62	Mobilgear 600 XP 150	-	-	3 x 20L	40L	Bunker cranes	-
63	Mobilgear 600 XP 220	-	-	2 x 20L	40L	Gearbox oil	-
64	Mobilgear 600 XP 460	-	-	2 x 20L	5L	Gearbox in the maturation silo	-
65	Mobilgear 600 XP 680	-	-	2 x 20L	5L	Gearbox in the maturation silo	-
66	Mobilgrease XHP 222	-	-	12 x 400g	19.2kg	Bearings	-
67	Mobil NUTO H 46	-	-	20L	60L	Pumps	-
68	Total Preslia GT 46	-	-	3 x 208L	104L	Lubricant for turbine	-

69	Ridgid Dark Thread Cutting Oil	-	-	2L	1L	Thread cutting machine oil	-
70	Total Multis Complex EP3	-	-	12 x 400g	4.8kg	Motor grease	-
71	Renolith 443 HD 88	-	-	12 x 400g	41.6kg	Double deck	-
72	Hydrogen	1333-74-0	Flammable, Gases under Pressure	4 x 50L	50L	Continous Emissions Monitoring	H220, H280
73	Ineregen Mixture of Gases (Oxygen, Carbon Dioxide, Argon 93%)	7440-37-1	Gases under Pressure	3 x 143kg	143kg	Fire Suppression	H280
74	Mixture of Gases (Anhydrous Ammonia, Nitrogen 99.98%)	7727-37-9	Gases under Pressure	2 x 10L	10L	Continous Emissions Monitoring	H280
75	Mixture of Gases (Carbon Dioxide 12%, Nitrogen 88%)	124-38-9 7727-37-9	Gases under Pressure	2 x 50L	50L	Continous Emissions Monitoring	H280
76	Mixture of Gases (Dinitrogen Oxide, Nitrogen 99.998%)	7727-37-9	Gases under Pressure	2 x 50L	50L	Continous Emissions Monitoring	H280
77	Mixture of Gases (Hydrogen chloride, Nitrogen 99.76%)	7727-37-9	Gases under Pressure, Corrosive (Skin Corr. 1B)	10L	10L	Continous Emissions Monitoring	H280 H314
78	Mixture of Gases (Nitrogen dioxide, Nitrogen >99.99%)	7727-37-9	Gases under Pressure	50L	50L	Continous Emissions Monitoring	H280
79	Mixture of Gases (Oxygen, Nitrogen 99.6%)	7727-37-9	Gases under Pressure	3 x 50L	50L	Continous Emissions Monitoring	H280
80	Mixture of Gases (Oxygen, Nitrogen 92%)	7727-37-9	Gases under Pressure	2 x 50L	50L	Continous Emissions Monitoring	H280
81	Mixture of Gases (Oxygen, Nitrogen 98%)	7727-37-9	Gases under Pressure	2 x 50L	50L	Continous Emissions Monitoring	H280
82	Mixture of Gases (Propane, Nitrogen >99.99%)	7727-37-9	Gases under Pressure	2 x 50L	50L	Continous Emissions Monitoring	H280
83	Mixture of Gases (SO2, CO, NO, Nitrogen >99.9%)	7727-37-9	Gases under Pressure, Acute Tox. 4	3 x 50L	50L	Continous Emissions Monitoring	H280 H332
84	Mixture of Gases (Sulphur dioxide, Nitrogen >99.91%)	7727-37-9	Gases under Pressure	3 x 10L	10L	Continous Emissions Monitoring	H280
85	Nitrogen	7727-37-9	Gases under Pressure	3 x 50L	50L	Continous Emissions Monitoring	H280